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ANCIENT FAUNA OF MONGOLIA DISCOVERED BY THE THIRD ASIATIC EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY[1]

IT is a very significant fact in the history of palaeontology that the homeland, or chief center of evolution or adaptive radiation, of the mammals during the Age of Mammals and of the reptiles during the Age of Reptiles is the very last to be explored. Beginning with the first palaeontological work toward the close of the eighteenth century in Europe, continuing with the thorough exploration of Europe and southern Asia during the nineteenth century and with the wonderful discoveries in reptilian and mammalian history in North and South America from the middle of the nineteenth century onward, the homeland was still left untouched, unexplored. Discoveries in North America were so extensive and so revolutionary that many thought the homeland had been revealed in our great western fossil beds. Positive claims were advanced by Ameghino for Patagonia as the homeland of proboscidea and primates. As a residuum of these discoveries in the western hemisphere, it proves true that several orders of mammals did originate in the Americas, but the ancestral stock from which these orders radiated was still to be found. Speculation wavered between the northern hemisphere and the southern hemisphere and some zoologists advocated both hemispheres in so-called bipolar theories. Thus sprang up two new branches of science—Paleogeography and Paleometeorology—centering in more or less inductive and deductive schools of thought.

In 1889 the New York Academy of Sciences adopted a new rule, namely, that its presidency should be held not for long terms but for two-year terms, and a new condition of the presidency was the preparation of a serious presi-

[1] Address to the New York Academy of Sciences at a special meeting May 21, 1923.

dential address. In accepting this responsibility and honor the writer took the task very seriously, retired to the most secluded spot in the American Museum, namely, the sixth floor of the southeast tower, and, aided by his colleague, William K. Gregory, began to attack the problem of the homeland of the mammals. The results of two very hard years' work were delivered in the two successive winters of 1899 and 1900 and published by the academy in 1900.[2] In these addresses the succession of mammalian life in western Europe as studied by Charles Depéret was for the first time compared step by step with the succession of mammalian life as known in North America. Parallels previously drawn, especially those of Edward D. Cope, were pointed out; others were added. It was found that there was remarkably close resemblance between the life history of Europe and that of the Rocky Mountain region; there are some interludes of separation, but in the main there are longer periods of affinity. Consequently we confirmed Joel A. Allen's generalization that Sclater's division of the northern hemisphere into Palaearctica and Nearctica should be united into a single holarctic province and proved that Holarctica extended back as far as the Lower Eocene period of the Age of Mammals.

Two other generalizations followed: first, that Africa must have been an important and independent center of mammalian evolution during the whole period of the Age of Mammals; second, that in Africa there probably originated four great orders of mammals, namely, the Proboscidea, the Hyracoidea, the Sirenia and the ancient whales, Archaoceti. Of these, traces of Sirenia and the ancient whales had already been found. Two years later this generalization was confirmed by the discovery of Beadnell and Andrews in northern Egypt of the ancestors of Proboscidea and of the Hyracoidea, namely, primitive mastodons and primitive coneys.

The third generalization was of even a more sweeping character and had been adumbrated more or less clearly by many zoologists and palaeontologists from the time of Buffon; it was that the chief homeland of the mammals was not in Africa nor in southern Asia nor in Europe nor in either of the Americas, but in the unexplored regions of the roof of the world, namely, of the central plateaus north of the Himalayas. These third and fourth generalizations are expressed in the paleozoologic map. A similar theory was subsequently advocated by J. L. Wortman and was set forth with very great fullness by William D. Matthew in his well known paper published by the academy.

How far this succession of addresses and papers fired the imagination of Roy Chapman Andrews we do not know, but it may be clearly stated that the chief object of the Third Asiatic Expedition was the exploration of the unknown roof of the world. The results have far surpassed our fondest hopes. Far more than a new chapter—a new *volume*—has been opened up in the history of the earth. Central Mongolia proves to be the homeland not only of the *Mammalia* but of the *Reptilia* as well; a single year's work (1922) demonstrates this, and the present season of 1923 will confirm and extend it and will, we hope, reveal the mammals of the basal Eocene and upper Cretaceous, as yet undiscovered. Roy Chapman Andrews, leader of the expedition, was prepared for his very responsible task by several preceding years of exploration in China. The territory he explored in 1922 had been crossed by Raphael Pumpelly in 1862-65; by Richthofen in 1877, who named these Tertiaries the Khan-Khai beds; by Obrutchev in 1892-94, who applied the name "Gobi Series" to the tertiary sediments; and by Chernov in 1908.

As developed in China, the underlying series of rocks, from the Jurassic downwards, had been described by von Richthofen and later by Bailey Willis in his researches in China of

[2] 1900.182. The Geological and Faunal Relations of Europe and America during the tertiary period and the theory of the successive invasions of an African fauna. *Science*, N.S., Vol. xi, No. 276, Apr. 13, pp. 561-574.

1900.187. Correlation between tertiary mammal horizons of Europe and America. An introduction to the more exact investigation of tertiary zoogeography. Preliminary study with third trial sheet. . . . Presidential address before N. Y. Academy Sci. delivered February 26, 1900. With a list of the author's scientific publications, 1878-1899, appended by direction of the Council of the Academy. *Ann. N. Y. Acad. Sci.*, Vol. xiii, No. 1, July 21, 1900, pp. 1-72.

1907. Our geologic party found a great unconformity separating the folded sediments of Jurassic and earlier time from all of the desert basin sediments; after the Jurassic period the marine sediments of the roof of the world ceased. Above the Jurassic and also above the Great Unconformity, sediments are entirely epicontinental—*this Cretaceous-Tertiary continent constituted the homeland of the chief orders of reptiles and mammals!*

The series underlying the Great Unconformity from the Archean to the Jurassic had been recognized by Willis in China, and that pioneer work was of great help to the geologists of the expedition. The Nan-K'ou Series of China seems to be continuous across Mongolia. A great bathylith was found by our party invading these older metamorphic rocks and extensively exposed by erosion. It is on this complex erosion floor that all of the later Cretaceous-Tertiary strata were laid down, some of which were again swept away by the Post-Jurassic interval. The Later Mesozoic and Cenozoic sediments of Mongolia lie upon the peneplaned surface of this complex of old deformed rocks with its Great Bathylithic Invasion. This is a wide contrast to conditions in the Rocky Mountain Plateau region of America, where marine sedimentation continues to the very close of the Cretaceous and the Tertiary sediments overlie either the Cretaceous or the Jurassic. Above the great Post-Jurassic unconformity ten new formations were discovered by our expedition and more or less clearly distinguished from each other by their vertebrate remains, according to the field determinations by Granger and Berkey. Four of these are in the Cretaceous, two at the confines of the Eocene and Oligocene, three in the Miocene, one in the Pliocene.

The only precedent to the magnitude and novelty of this reconnaissance in the geologic history of the arid regions of the world is to be found in the early surveys of our own western territories by Hayden as geologist-in-chief, Holmes as topographer and Leidy as vertebrate paleontologist.

SUMMARY OF FOURTEEN NEW FOSSIL-BEARING FORMATIONS DISCOVERED

Zones.

1. Pleistocene. An erosion epoch.
2. Pliocene. Cervus (Elaphus?) zone. Determined August 27, 1922.
2. Miocene. Not yet defined by determination of fossils.
2. Middle Miocene, Houldjin, Hsanda Gol, *Baluchitherium* zone, in two localities, *B. grangeri.* April 30, August 5, 1922.
1. Upper Eocene, Irdin Manha. *Protitanotherium zone. P. mongoliense,* April 27, 1922.=Uinta Beds of Utah.
1. Lower Eocene. Fossils not identified. September 14, 1922.
1. Upper Cretaceous. Iren Dabasu dinosaur beds.=?Ceratops, or Triceratops Beds of Montana. April 25, 1922.
2. Lower Cretaceous, Dja-doch-ta. Protoceratops zone. Ancestors of the Ceratopsia. September 2, 1922. No equivalent in N. America or Europe.
1. Jurassic. Plant remains.
1. Permian. Marine invertebrate remains. September 7, 1922.

—

14 new life zones.

The geologic personnel of the expedition included Charles P. Berkey as chief geologist; Frederick K. Morris as geologist and topographer; Walter Granger as vertebrate palaeontologist. The entire personnel under Leader Andrews included a party of twenty-five—eight Americans, eight Chinese, nine Mongolians. By means of a train of seventy-five camels and two freight and three light automobiles, a three thousand mile reconnaissance was made between April 18 and September 20, 1922, when the party returned to Peking. The work was greatly aided by the Geological Survey of China, now under the management of Dr. V. K. Ting, honorary director, and Dr. W. H. Wong, acting director, with headquarters in Peking. On reaching the confines of Mongolia Berkey and Morris began a systematic and continuous route map and geologic cross section, which was carried throughout the whole itinerary. These studies early in the work determine the major structural and formational units and locate the major unconformities and other physical changes. The great Post-Jurassic unconformity, the Pre-Jurassic unconformity, the lesser Post-Cretaceous unconformity and the

Great Bathylithic Invasion were one after the other definitely distinguished.

The itinerary of the geologic party and series of discoveries are briefly stated by Professor Berkey as follows:

Left Kalgan April 21. Went into camp at Iren Dabasu after finding rhinoceros jaw evening of April 24. First dinosaur bones found at Iren Dabasu morning of April 25 by Berkey before breakfast. Camp was divided April 25, leaving the geologic group, Morris, Granger and Berkey, at Iren Dabasu, giving special attention to the collecting of fossils. First finds of Titanotheres and other early Tertiary fossils by Granger at Irdin Manha April 27. Additional finds made at Irdin Manha by the geologic group May 2. First Baluchitherium bones found at Houldjin in the vicinity of Iren Dabasu, April 30, by Berkey. Geologic group stayed at Iren Dabasu until May 7. Basin later referred to as Tsagan Nor Basin was entered first at Mt. Uskuk June 21 by the whole party. First exploratory trip to Loh June 22 by the group, with recovery of a few fragments of bones. Discovery of dinosaur bones and fossil insects and fossil fish June 25 in the Ondai Sair locality by Berkey and Morris. Three great collections of Later Tertiary fossils judged to be of Miocene age made by Granger at Loh in the Hsanda Gol formation June 27-August 3. Discovery of Baluchitherium skull at Loh August 4 or 5 by Granger and Wong. Discovery of stag, mastodon, etc., judged to be of Pliocene age in the Hung Kureh district July 27 by Berkey. Whole group made collections later. Left the Tsagan Nor Basin August 13. Discovery of dinosaurs in the Ashile District by Granger August 20-27. Side trip to the Gurban Saikhan across a new basin by Morris and Berkey August 19-27. Discovery of Protoceratops by Shackelford at Dja-doch-ta September 2. Additional collections by the whole party. Discovery of Paleozoic strata with Permian fossils September 7 in the Sair Usu district by Berkey and Morris. Discovery of Ardyn Obo fossil-bearing beds September 10. Collections by the whole party. Discovery of Eocene forms in the sedimentary beds of Shara Murun by Granger and Andrews September 14. Discovery of fragments of bone in the sediments at the edge of the Mongolian plateau above Kalgan by Berkey September 19.

The first fossils brought back by Mr. Shackelford, photographer of the expedition, included the three great discoveries of the season, namely, (1) a superb *Baluchitherium* skull found east of the Altai Mountains, which is now being fully described by the writer; (2) a complete skull of *Protoceratops*, a pre-dentate dinosaur, ancestral to the giant Ceratopsia, just described by William K. Gregory; (3) jaw of *Protitanotherium*, which will shortly be described by the writer in *American Museum Novitates*. The main shipment of the Mongolian collection has just reached the American Museum and includes all the fossils collected on this very rapid reconnaissance. During the present season the same beds are being visited by a strong collecting party and already reports of additional discoveries of importance are reaching the museum.

HENRY FAIRFIELD OSBORN

SOME EXPERIMENTAL STUDIES ON THE CENTRAL NERVOUS SYSTEM[1]

ONE of the great contributions of the last century to the field of biological science was the application of experimental methods to the study of development, and the factors underlying the production of individual structure. Though many of the fundamental facts of embryology were known, the complexity of the factors which operate during the process of development was so great that further progress could be accomplished only by segregating or isolating certain structural units and by changing intrinsic and extrinsic relations to so modify the conditions of development that some tentative answers could be made to the question of causation in development.

One of the interesting problems in nervous embryology has been: What makes neuroblasts differentiate into neurones? and as a corollary to that, Why do neurones, whose cell bodies lie in a certain region, grow over a definite pathway and establish connections with another group of neurones so that they may become part of a complex chain of nervous units?

By experimental methods, Dr. Harrison has shown clearly that neuroblasts will develop into neurones when isolated from many of the normal environmental factors. Primitive nervous tissue from the central nervous system of the

[1] A paper read before the Tri-State Medical Society in New Haven, April 19, 1923.

chick will grow in tissue cultures into apparently normal neurones. So long as the growing nerve cell is supplied with the necessary food, a certain amount of growth and differentiation will follow, without the presence of many of the normal conditions of development such as position with respect to other cell masses, hormones, chemical constituents of blood, of functional activity, etc. Just how complete this growth is, just how perfect a neurone is developed under such experimental conditions is of course questionable. But at least one fact was thereby established, namely that nervous tissue inherits a certain potential for differentiation which will result in a considerable degree of development of a cell even though isolated from its normal environment.

Stimulated by Dr. Harrison, though using somewhat different methods and working with another form of animal, I have been engaged for the past few years in studying some of these problems. The larvæ of a small native salamander, Amblystoma, are peculiarly suitable for experimental work of this sort. They grow in quantity in the pools around New Haven, can be readily kept in the laboratory and can be operated upon before the development of the peripheral nerves, without asepsis. It is possible under laboratory conditions to remove or transplant portions of organ systems, to isolate organs such as the eye or nose, to interpose organs, an eye for an ear for example, to move organs from their normal position to some strange location, an ear on to the flank and so on. All these operations are performed before the development of the peripheral nerves and hence removes the disturbing factors of shock and pathological sequelæ.

The results of several years of such experimentation have shown a number of interesting things. If the primordium of the nasal apparatus be removed at an early stage, that part of the brain to which the olfactory nerve runs for a time develops normally, then as functional activity begins, it lags behind the hemisphere with undisturbed relations. This confirmed by experimental methods a theory of Roux that in the development of the nervous system two periods could be observed, the first one of growth and differentiation in which the primitive cells was transformed into a specialized neurone and the second one of pure growth during which the size of the neurone increased markedly, and its connections were more completely established. As a result, we find that the absence of an olfactory sac, and hence the olfactory nerve results in the retardation of the normal growth of the cerebral hemisphere, or in other words, when the olfactory nerve and sac are present, the hemisphere will grow to a greater size than when it is lacking. These results suggested the possibility of function as the stimulating factor in the second, or growth period, of nervous development.

In order to determine exactly whether or not this was so, a second series of operations were performed in which the entire cerebral hemisphere with the nasal apparatus attached, was transplanted back onto the trunk of Amblystoma larvæ. In a portion of these transplantations, the transplant was so placed that the olfactory placode healed in beneath the skin so that there was little possibility of its functioning. In the rest, the complex was placed with the olfactory sac at the surface so that it might conceivably function. The results of these operations showed that the stimulating factor for the second growth period was probably not functional activity but rather the stimulus afforded by the ingrowing olfactory nerve, since in both series the size of the hemisphere closely approximated the normal undisturbed hemisphere.

Questions that immediately arise are: How potent a factor is this stimulation which results from a nerve trunk or tract growing into a collection of nerve cells? Would it be great enough to bring about regeneration of such a mass and would the presence of a nerve trunk larger than normal produce an enlargement of such a mass of nerve cells?

To answer the first question a series of embryos were operated upon in which the cerebral hemisphere was removed, and the olfactory sac returned to its normal position. In the process of healing the inter-ventricular foramen left open by the removal of the hemisphere was closed in by a thin layer of cells derived from the ependymal lining of the neural tube. When the ingrowing olfactory nerve reached this new portion of the wall of

the neural tube, the latter were stimulated to differentiate and develop into a complete new hemisphere, which in both structure and size was apparently a completely normal hemisphere. We can, therefore, answer the first question in the affirmative. A group of axones growing into a collection of primitive cells is able to cause them to regenerate a complete new part of the brain.

To determine the stimulating effect of a larger nerve trunk than usual on neuroblasts, an extra olfactory sac was transplanted beside the normal one in such a way that the ingrowing nerve trunk could establish connection with the hemisphere. Here, though, in some instances the olfactory nerve did not reach the cerebral hemisphere. In those cases in which it did, the hemisphere increased in size markedly over the normal hemisphere. The results obtained showed that the growth into the cerebral hemisphere of more axones from olfactory neurones than normal produces an enlargement of an embryonic nervous cell mass, since the hemispheres in such operated embryos eventually grew to be approximately 20 per cent. greater than normal.

The experiments show, then, that the removal of an end organ results in the failure to grow to full size of the part of the brain with which it is connected, that ingrowing fibers from such an end organ can stimulate the primitive ependymal lining of the neural tube to form a new portion of the brain and that a superabundance of such ingrowing nerve fibers can stimulate the normal brain to increase in size approximately 20 per cent.

To put it in another way, the above experiments show that nerve cells grow, first as a result of an inherited potential for differentiation, and secondly as a result of stimulus derived from the contact of telodendria from other neurones. This latter stimulus is, in Amblystoma, sufficiently strong to produce regeneration and hyperplasia of the cerebral hemispheres. Functional activity is not excluded as a factor since we do not yet know what occurs when neurones establish connections within the central nervous system. The exteroceptive phase of functional activity at least has little or no effect.

H. S. BURR

YALE UNIVERSITY SCHOOL OF MEDICINE

APRIL 19, 1923

THE MASKELL COLLECTION OF COCCIDÆ

WILLIAM MILES MASKELL was registrar of the University of New Zealand. He pursued the study of the Coccidæ when not busy with the arduous duties of his official position. His first paper was published in 1879. With the exception of four years, he published an annual illustrated memoir, 1879-1898, in the *Transactions* of the New Zealand Institute. In addition to the memoirs about twenty other papers were published. These included a very large number, several hundred, new genera and species. He had the advantage of being located in the midst of a marvelously rich coccid fauna.

Many of the species of Coccidæ have proved to be of economic importance. This has resulted in the discovery of many new forms. The description and study of these new forms has brought to light many characters either not figured or not described or noted by Maskell, so that his genera and species needed to be restudied in order to determine their correct affinities and to permit of their proper location in the classification of the family. The officials of the U. S. Bureau of Entomology were able through the assistance of Mr. T. W. Kirk of the New Zealand Department of Agriculture to borrow this collection, which reached Washington in 1909.

The remounting and study of the collection was begun immediately. The first results of these studies, thirteen years after the reception of the collection, have appeared and deal with the species of Maskell that have been made the types of genera by Maskell and others. This contribution is by Harold Morrison and Emily Morrison, printed in the *Proceedings* of the U. S. National Museum for 1922.

There is included a discussion of the species belonging to seven subfamilies, and thirty-seven genera and subgenera. The authors have attempted to describe each species so fully and to figure all parts so carefully that future workers would have no need to consult the original type-material. How successfully this has been done only time will show, for with the advancement of the classification of a group, each generation frequently uncovers characters not hitherto used, so that it is very difficult for the workers of one generation to unearth all the characters that will be used by succeeding gen-

erations. Long but concise carefully prepared descriptions covering all parts are given. These are amplified by the numerous figures of the insects as a whole and of their various parts in great detail. The figures of a species are grouped together and printed as text-figures. While it is always of importance to have a figure near the description for comparison, yet the effect and detail of figures printed upon plate-paper is so much better than those printed on ordinary print-paper that convenience should have been overlooked, particularly in a work of such value to future students of the Coccidæ as this one. Figures where one half shows the dorsal surface and the other half the ventral surface are being produced by many authors. This is to be deplored because such figures never give the perspective of the insect as a whole that can be secured from complete figures of each surface while there is always confusion and doubt as to the accuracy of the structures located on and near the meson, and so long as the government is financing the project, the question of expense should not be a serious one. This is particularly unfortunate in figures of the anal ring, a structure that is going to be used much more in the future than in the past, especially in the subfamily Eriococcinæ and its allies. The figures showing the anal ring are all on too small a scale or very indifferently done and do not bring out their pertinent characteristics. An admirable feature of this contribution is the attention given to other individuals than the adult female, the first nymphal stage and the adult male where available being described.

This is one of the very best studies of the Coccidæ made by an American in many years, regardless of my criticisms, and the authors are to be congratulated on starting this series of studies with such a thoroughgoing piece of work. It is to be hoped that they will follow the policy of Maskell and publish at least one large contribution each year until the study is completed. If our National Museum is to retain its supremacy so far as the Coccidæ are concerned it must be by contributions to their study and not by number of insects in cases.

ALEX. D. MACGILLIVRAY
UNIVERSITY OF ILLINOIS

SCIENTIFIC EVENTS

SHAD INVESTIGATIONS IN CONNECTICUT

AN investigation of the cause of the marked depletion of the Connecticut River shad is being undertaken by the Connecticut State Board of Fisheries and Game. The commercial catch of shad has decreased alarmingly since 1919. The number of eggs obtained for artificial propagation has also decreased during recent years. The work now in progress includes: (1) Experimentation with methods of catching shad for spawn taking, (2) a study of the feeding habits, periods of migration and other phases of the life history of the shad, (3) studies of the enemies of larval and young shad, of parasitism and of other phases of pathology, (4) a detailed study of ecological conditions, including pollution, of the tributaries of the Connecticut in which shad are known to spawn, and (5) tagging of adult shad in an attempt to follow successive migrations. Another experiment is designed to test the possibility of furnishing comparative security to young shad by retaining a part of the product of the hatchery in specially prepared ponds freed from other fish.

The staff engaged in this work includes: Mr. J. W. Titcomb, superintendent of the fisheries and game of Connecticut; Dr. P. H. Mitchell, of Brown University, director of the investigations; Dr. Emmeline Moore, who is enabled to undertake this work through the courtesy and cooperation of the New York State Conservation Commission of which she is biologist; Dr. J. E. Blair, of Leland Stanford University; Mr. H. E. Gallup and Mr. F. B. Littlefield, of Harvard Medical School.

The Connecticut legislature has appropriated $10,000 for this work. The investigations will be continued through the summers of 1923 and 1924.

PASTEUR CELEBRATIONS IN FRANCE

THE official French celebration of the centenary of Pasteur began in Paris on May 24. According to an article in the *British Medical Journal* many delegates from universities and institutions throughout the world attended a reception given by the president of the French Republic. On the following morning the delegates were welcomed by Dr. Roux at the Pas-

teur Institute; a bust of Pasteur erected in the gardens of the institute was unveiled and wreaths laid at its foot by foreign delegates, who afterwards visited the museum and the crypt, where is the tomb of Pasteur. Later in the day there was a great meeting in the amphitheater of the Sorbonne, presided over by the president of the republic, who was accompanied by the ministers, by members of the diplomatic corps, by members of the five academies of the Institut de France and the Académie de Médecine and by foreign delegates to the number, it is said, of some seven hundred. The proceedings began with the unveiling by M. Paul Appell, Rector of the University of Paris, of a marble tablet placed by the university in the Salle des Autorités, bearing an inscription stating that it has been erected on the spot where "le grand Français et le grand Anglais Lister se sont embrassés" to commemorate "cette étreinte fraternelle, symbole de l'amitié de deux peuples." Afterwards the Marquess of Crewe, British ambassador in Paris, expressed the deep appreciation of this homage to Lister paid in the heart of the intellect of France. The popular celebration took place on Sunday, which was a flag day in Paris and the chief towns of France, and badges were sold for the benefit of the laboratories of France. In the afternoon the delegates attended a reception given by the City of Paris at the Hôtel de Ville. On Monday a visit was paid to Versailles, when a bust of Pasteur given by his daughter and son-in-law, Mme. and M. Vallery-Radot, was unveiled in the Galerie de Glaces. The president of the Republic during the previous week started on a tour, during the course of which he took part in celebrations at Arbois and Strasbourg.

IN HONOR OF PROFESSOR MORSE

FROM an article in the *Boston Transcript* we learn that to celebrate the eighty-fifth birthday of Professor Edward S. Morse of Salem, twenty members of the Boston Malacological Club visited him in his laboratory at the Peabody Museum in Salem, on June 18, to congratulate him and wish him years of useful work in the future. The visitors were headed by President Arthur F. Gray, of Watertown, who at an appropriate moment presented Dr. Morse with a silver pitcher and tray, the former suitably inscribed, giving at the same time a short review of some of Professor Morse's special researches. "Since 1856 this active scientific man has been busy with many lines of scientific and artistic work, never forgetting his first deep interest, the shells of which he described a new species while merely a boy. His splendid labors in Japan, where he was one of the famous group of teachers who laid the firm foundations of education in that country, were touched upon with a sketch of the later researches largely in connection with the Peabody Academy in Salem."

Following a basket luncheon, the company adjourned to the home of Professor Morse, where the afternoon was spent in looking over his treasures, including two splendid decorations from the emperor of Japan, autographed volumes, models of the skull of early man, shell studies and a host of special items. Not the least interesting feature was a stroll with Professor Morse through the Weld Hall of Japanese curiosities, where he gave the company special descriptions of many of the things there shown, noting in places how they had been secured.

Present in the company were three of the original nature class given in Salem in the year following the celebrated start of the idea by Professor Agassiz, namely, J. H. Blake, student under Agassiz and artist for his expeditions; James H. Emerton, authority on spiders, and Arthur F. Gray, who acquired collections and books of Binney, a great conchologist of Massachusetts.

THE DIRECTORSHIP OF THE MOUNT WILSON OBSERVATORY

BECAUSE of persistent ill health, which has greatly reduced his working capacity during the last fifteen years and repeatedly threatened the necessity of complete retirement, Dr. George Ellery Hale has felt compelled to request of the Carnegie Institution of Washington a material reduction of his responsibilities as director of the Mount Wilson Observatory. On the recommendation of President Merriam, the executive committee of the institution has adopted a resolution appointing Dr. Hale honorary director of the Mount Wilson Observatory, with

the understanding that he will remain in charge of its general policy and continue to give special attention to the development of new methods and the attack upon new problems. On July 1, when the new arrangement goes into effect, Dr. Walter Sidney Adams, who has had long and successful experience as assistant director of the observatory and also as acting director during Dr. Hale's absence, will become director of the observatory in charge of operations. Dr. Hale's purpose in requesting relief is to find a means of accomplishing in the future the greatest possible amount of scientific work that his health will permit. He is still in Europe, but hopes to be able to return to Pasadena in October.

SCIENTIFIC NOTES AND NEWS

AT a meeting of the council of the University of Strasbourg held on May 24, the honorary degree of doctor of the University of Strasbourg was conferred upon Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research.

AT the commencement exercises of Yale University the doctorate of science was conferred on Dr. Walter B. Cannon, professor of physiology in the Harvard Medical School; Dr. Jacques Loeb, of the Rockefeller Institute for Medical Research; Dr. Henry F. Osborn, president of the American Museum of Natural History; the degree of master of arts was awarded to Joseph H. Pratt, state geologist of North Carolina.

PRINCETON UNIVERSITY has conferred the doctorate of science on Dr. Theodore William Richards, Erving professor of chemistry and director of the Wolcott Gibbs Memorial Laboratory at Harvard University; and on General John Joseph Carty, of New York City, chief engineer and vice-president of the American Telephone and Telegraph Company.

AT Harvard University, the doctorate of laws was conferred on Dr. Samuel W. Stratton, president of the Massachusetts Institute of Technology.

AT the commencement of Wesleyan University the doctorate of laws was conferred on Dr. James Rowland Angell, president of Yale University, and the doctorate of science on Dr. Robert M. Yerkes, of the National Research Council.

DR. A. H. GILL, professor of technical chemical analysis at the Massachusetts Institute of Technology, received the honorary degree of doctor of science from the Rhode Island State College at its thirtieth annual commencement. The degree of master of science was conferred on Robert H. Smith, assistant professor of machine construction at the institute.

DR. H. A. LORENTZ, professor of physics in the University of Leyden, who has been lecturing in England, was the guest of the Anglo-Batavian Society at a dinner given in London on June 6. Following the speech of Professor Lorentz, responses for other guests were made by Lord Haldane and Professor G. N. Lewis, of the University of California.

SIR WILLIAM BRAGG has been elected to be Fullerian professor of chemistry at the Royal Institution and director of the laboratory and of the Davy Faraday Research Laboratory, in succession to Sir James Dewar.

DR. D. ROBERTS HARPER 3d, physicist of the National Bureau of Standards, has been detailed to New York for service as liaison officer between the Bureau of Standards and the American Engineering Standards Committee in the Engineering Societies Building, succeeding Dr. A. S. McAllister, of the Bureau of Standards, recalled from New York to Washington. Dr. McAllister takes charge of part of Secretary Hoover's special work in relation to commodity standards and specifications, inaugurated recently under the Bureau of Standards.

THE department of entomology of the University of California, and the staff of the museum of the California Academy of Sciences gave a complimentary dinner at the Hotel Stewart, San Francisco, on June 2, to Professor and Mrs. T. D. A. Cockerell, who were passing through San Francisco on their way to Siberia. Thirty-six were at the table, including many of the leading biological workers of the Bay Region of California. Dr. Barton W. Evermann acted as toastmaster. All present joined in wishing their guests a pleasant voyage and abundant success in their quest for fossil insects.

DR. HARRY R. SLACK, JR., associate in laryngology in the Johns Hopkins Medical School, who has been exchange professor in Peking Union Medical College for the past year, sailed on June 20 from Shanghai. Dr. Slack will spend some time in the clinics of Vienna and Paris before returning to America about October 1.

DR. ADOLPH MEYER, psychiatrist-in-chief of the Johns Hopkins Hospital, has gone to Europe to visit his old home in Zurich, Switzerland, and to inspect psychiatric clinics in England, France and other European countries.

ON May 17 Professor Edward L. Nichols, of Cornell University, lectured before the students of Wellesley College on "Science in the colleges."

DR. EDGAR FAHS SMITH, lately provost of the University of Pennsylvania, delivered the commencement address at the University of Arkansas on June 12. While in Fayetteville he addressed the Arkansas Section of the American Chemical Society, and was guest of honor at a luncheon given by the section.

DR. ARTHUR LACHMAN, research associate at the University of California, spoke on "The present status of organic chemistry" at Northwestern University on May 10, and at the University of Chicago on May 17.

ON Monday evening, June 11, resident members of Sigma Xi and other men interested in scientific research at the State College of Washington, met at a dinner with Dean Edward Ellery, national secretary of Sigma Xi. In the afternoon of the same day, Dean Ellery delivered a lecture on "The structure of the atom," illustrated by the film prepared in the research laboratory of the General Electric Company, and the following morning gave the annual Phi Kappa Phi address on "The rôle of science in the spiritual evolution of man."

PROFESSOR C. MOUREU, president of the Chemical Society of France, gave a lecture on "Les gaz rares des sources thermales, des grisous et autres gaz naturels" at the rooms of the Chemical Society, Burlington House, on June 14.

JOSEPH KEELE, a member of the staff of the Geological Survey of Canada, died on June 11. Mr. Keele spent the earlier years of his connection with the survey in making geological explorations in Yukon and Northwest Territories. He is better known for his work on clays and shales of Canada in their application to the ceramic industries.

DR. G. H. HUME, for many years lecturer on physiology in the University of Durham College of Medicine, died on May 8, aged seventy-seven.

MR. WILLIAM HENRY PEARSON, of Manchester, England, well known for his studies in Canadian and tropical Hepaticae, died recently of pneumonia in his seventy-fourth year.

JOSEPH WRIGHT, the Irish naturalist, died on April 7 at the age of eighty-nine years.

THE *Journal* of the American Medical Association states that a Portuguese merchant who had amassed a fortune in Brazil and returned to Lisbon to live, recently bequeathed his fortune to found an institute for scientific research, naming Professor Ferreira da Mira as the one to have charge of the institution. No specifications as to site, scope or other details were made and no scientists knew of the provisions of the will in advance. As Professor Ferreira de Mira had no personal acquaintance with the testator, and as he is the incumbent of the chair of biology, the council that was organized by the state for the creation of the institute decided that Lisbon should be the location and the biologic sciences the field of the Bento da Rocha Cabral Institute for Scientific Research.

THE Australian Institute of Tropical Medicine was opened at Townsville in 1913, in the part of the great continent that lies within the tropics, with Dr. Anton Breinl as the first director. He resigned in 1921, and the institute became dormant. We learn from the *Journal* of the American Medical Association that, with the creation of the commonwealth department of health, the institute has been reconstructed. Its activities include the establishment of laboratories to render assistance to physicians in bacteriologic, protozoological and biologic work, and the organization of a service to deal with tropical diseases in Australia and her dependencies. Work on hookworm disease has been done with the assistance of the Rockefeller Foundation. The whole of Australia and her dependencies have been surveyed, and the distribution of hookworm disease has been de-

termined. It is proposed to establish permanent measures of control and thus to eradicate the disease. By arrangement with the Rockefeller Foundation, a section of the work will be carried out with the collaboration of the Australian Institute of Tropical Medicine. Also, an inquiry into the incidence of malaria and filariasis has been begun. The staff is being reappointed, and Dr. R. W. Cliento, a recent graduate of Adelaide University, has been appointed director. He has been sent on a tour to Java, Ceylon, India, Italy, England, the United States and the Panama Zone to study the methods of control of tropical diseases. Arrangements have been made with the Universities of Melbourne and Sydney for the instruction in tropical medicine required for a diploma.

THE British Medical Research Council announces officially that insulin, the new treatment for diabetes which was discovered at Toronto by Dr. Banting, and which is an extract of the island tissue of the pancreas, is now being "used in treatment for the relief of patients selected for the purpose at each of the following hospitals: In London, at St. Bartholomew's, Guy's, St. Thomas's, the London and University College; in Sheffield, at the University Departments of Pharmacology and Physiology and at the Royal Infirmary; in Edinburgh, at the Royal Infirmary." Arrangements are in progress for extending this work to other hospitals and institutions "where the necessary conditions both personal and material can be provided. Every effort is being made to increase the supply of insulin, so that it may be available for use in general practice." The following official announcement has been made public: "The council are able to say that the progress towards successful large-scale production has been more rapid than they had ventured last November to hope. . . . Subject to limitations of raw material in particular districts, successful manufacture is now (they believe) assured; but a period of some weeks must pass before laboratory tests and clinical use under special safeguards will have made it justifiable for a supply to be issued generally for routine use under the ordinary conditions of medical practice."

THE British National Poultry Council announces that the Ministry of Agriculture intends to proceed without further delay with those parts of the institute scheme that have to do with research in connection with breeding, disease and nutrition. These sections do not require so much preparation as the other parts of the scheme, and it is anticipated that, as £5,000 of the required contribution from the industry has been secured, the balance of £1,500 will be forthcoming shortly, thus rendering available the whole of the £50,000 grant from the special fund sanctioned in 1921.

SHORTLY before the war the Marquise Arconati-Visconti gave two million francs (then £80,000) for the erection in Paris of an institute for the study of the history of art and of archeology. The work was, however, suspended by the war and the high cost of materials four years later prohibited its resumption. In her will the Marquise provided that for four consecutive years a sum of 250,000 francs (about £3,500 at the present rate of exchange) be drawn from the revenues of her estate and devoted to the construction of the institute, which is to be erected in the Avenue de l'Observatoire.

THE cinema film taken in Australia in connection with the total solar eclipse of the sun at Wallal last September was shown at the Royal Albert Hall, London, on May 12 and following weeks. *The Observatory* writes: "Besides the actual eclipse with pictures of the corona, the film covers the experiences of the different eclipse expeditions (American, Australian, Canadian, English and Indian) from the time of their arrival in Australia to the time of their leaving. The American expedition, for example, is traced from Adelaide. The difficulties of transportation at Broome and of landing at Ninety-mile Beach, where there is a very large range in the tides and a heavy surf, are shown. The camp-life of the astronomers and the nature of the country at Wallal should also prove of interest. The part of the film dealing with the few minutes of totality will, of course, be run through in as many minutes, but the whole film, which should prove of general geographical and educational, as well as of astronomical, interest, will occupy an hour or a little more. The eclipse film will be screened along with other films showing life in Australia.

THE Hancock Life Insurance Company, Boston, has made an additional gift of $20,000 to the Harvard Cancer Commission; $5,000 to be used for purchase and installation of a diagnostic apparatus and $15,000 to be placed in the permanent fund. The insurance company previously gave $30,000 toward the building of the Huntington Hospital, which is devoted exclusively to cancer cases. The new gift will be used in the biophysical laboratory, which is also under the direction of the commission.

UNIVERSITY AND EDUCATIONAL NOTES

AT the commencement exercises of Harvard University President Lowell announced the receipt of gifts during the year amounting to nearly four million dollars. This sum includes the payment of pledges to the Harvard endowment of $1,080,619.

THE Tanners' Council of America has voted to erect a research laboratory at the University of Cincinnati, contributing $110,000 for the erection of the building.

TWO bequests, one of £30,000 and one of £20,000, have been made to the University of Melbourne Medical School.

DR. FREDERICK P. GAY, professor of bacteriology in the University of California, has accepted the chair of bacteriology in Columbia University.

PROFESSOR M. C. BURRITT and Professor W. H. Chandler, vice-deans of the New York State College of Agriculture, will retire at the end of the present academic year.

DISCUSSION AND CORRESPONDENCE

THE PREPARATION OF FIVE KILOGRAMS OF DESICCATED EUGLENA[1]

GOTTLIEB (1850), Kutscher (1898), Bütschli (1906) and others have attempted the collection of *Euglena* in amounts sufficient to warrant biochemical investigation of this relatively accessible microorganism. Their interesting results were in each case limited by the very small quantity of material attained by their methods of filtration and sedimentation. The present communication is offered as a suggestion that *Euglena*, and possibly other unicellular bodies, can be obtained in great quantities with less difficulty than might at first be apparent.

In 1921 a heavy scum, or "bloom" of *Euglena* (Sp.) appeared on one of the campus ponds. To concentrate this scum by filtration is impracticable. It was found, however, that the scum is sufficiently tenacious to permit its accumulation with the following device. By means of cords, a wooden float, consisting of a board 1.5 m. long, 10 c.m. wide and 5 c.m. thick, was suspended parallel to and from the small end of a long bamboo pole. To collect the material the pole was swung in arcs over the surface, dragging, or better, pushing, the scum close to a concrete embankment—an effect suggesting the skimming of cream with a gigantic spoon. The scum was then easily gathered with a large photographic developing tray and transferred in five or ten gallon lots to the laboratory.

After sufficient dilution, the euglenae were shaken until a uniform suspension resulted. This was strained through a "10-mesh" brass sieve to remove the gross débris. The fluid was then forced through a "60-mesh" sieve by stroking the upper surface of the sieve with a strip of pliant rubber. The suspension was allowed to stand in the dark for twelve hours in large jars to which cracked ice had been added. It was found that agitation followed by cold and darkness results in the euglenae settling sharply as a bottom sludge. The supernatant liquid, containing most of the foreign protozoa and some other floating particles, was siphoned off. Microscopic examination revealed that the sludge consisted of euglenae in a state of high purity.

The sludge was dehydrated by adding an equal volume of ninety-five per cent. alcohol, allowing the euglenae to settle, decanting the diluted alcohol and adding fresh; this procedure being repeated until the euglenae were in ninety per cent. alcohol. After a Buchner filtration, the filter-cake was granulated with a potato masher. The resulting damp granules were dried at 50°. From roughly 250 liters of

[1] 1850 Gottlieb, J. *Ann. d. Chemie u. Pharmacie* Bd 75 p. 51; 1898 Kutscher, F. *Zeitschr. f. physiol. Chemie* Bd. 24 p. 360; 1906 Bütschli, O. *Arch. f. Protisten.* Bd. 7 p. 197.

scum five kilograms of euglenae were obtained as a non-hygroscopic, dusty, gray-green, granular powder.

CHARLES E. BILLS

ZOOLOGICAL LABORATORY
THE JOHNS HOPKINS UNIVERSITY

SYRPHID LARVÆ AS PESTS

WE are all accustomed to regard the predacious larvae of several of our syrphid flies as distinctly beneficial insects. It was, therefore, a great surprise to learn, a few days ago, that the larvae of some of these flies were the cause of the closing of several canneries in the Santa Clara Valley, California.

During the past few years the business of canning spinach has grown until it is now an industry of considerable importance in California. Hundreds of acres are sown to this crop, the grower receiving about $20 a ton for the spinach cut and crated in the field. The average yield is four to six tons per acre.

Soon after the spinach began to come into the canneries this spring it was noticed that there was an unusual number of "worms" on the leaves and that many of these were not removed in the usual washing process and that some of them even found their way to the cans that were ready for sealing. The cannery men immediately stopped canning and sent word to the growers that no spinach infested with the "worms" would be received. This meant the loss of hundreds of thousands of dollars to the growers as well as tremendous losses to the cannery men who had already contracted to deliver what they had every reason to believe would be the largest output in their history.

An investigation showed that the principal cause of all this trouble was the larvae of one of our most common syrphid flies *(Lasiophthicus pyrastri)* which were feeding on the aphid *(Rhopalosiphum persicae)* which is a common pest of the spinach. The larvae of other syrphid flies were present also, but this *L. pyrastri* was the most common. The season had been a particularly favorable one for the flies and we found that the larvae were doing a remarkable work in destroying the aphids. But as some of them would stick to the leaves even through the washing process and turn white when the spinach was in the scalding water, their presence on the leaves when it was ready for the can was easily detected and, of course, the product could not be used.

A few days later the number of larvae to be found on the spinach in the field began to decrease very rapidly and at the end of a week they were so scarce that some of the cannery men decided to see whether by using particular care in picking over the spinach in the cannery they could not get a clean product. Even the most careful work, however, failed to dislodge all of the larvae and it was decided not to pack any more spinach this season, as the cannery men are determined that the pack that goes out from their places shall be perfectly clean. This means that the growers in this valley will lose approximately $400,000 because of the presence of this "friendly" insect in their fields.

Spinach that is planted early in the fall and is ready for the cannery in March is not infested by the aphids to any extent and the syrphid larvae are not to be found until the aphids are there. Early planting, then, is the remedy.

R. W. DOANE

STANFORD UNIVERSITY
APRIL 23, 1923

ON THE VITALITY OF COTTON SEED

AMONG our most destructive cotton diseases is anthracnose which is caused by the fungus *Colletotrichum Gossypii Southw.* So widespread and destructive is this disease in the cotton growing states that its literature is now quite extensive. In common with other members of the genus, the fungus infects the seed and in this way is carried over from one season to the next. It is, therefore, necessary in order to combat the disease effectively to secure uninfected seed for planting.

Treating the seed with fungicides has been tried with negative results. The difficulty encountered was the inability of the disinfectant to penetrate the seedcoats and so reach the fungus. The hot water method of treating seed was also tried and promised well but was later abandoned as unpracticable. The thermal death point of the fungus appeared to be too near that of the seed. From the results of previous work it appears that the ordinary method of seed treatment will give unsatisfactory results.

It is generally thought that the thermo death point of cotton seed is about 80°C., but the writer finds that the temperature which cotton seed can endure without affecting the vitality of the seed depends upon several factors. First, the amount of moisture present in the seed; second, whether heated in dry or moist atmosphere; third and perhaps the most important, whether there is oxygen present during the process of heating. If cotton seed containing a normal amount of moisture are placed in water at 70° to 80° C. the life of the seed will be destroyed. On the other hand if the cotton seed are thoroughly dried at low temperature, they can then be heated for ten to fifteen minutes at 100° C. in a dry atmosphere without affecting the vitality. But this treatment destroyed only a small percentage of the fungus. We have found that by thoroughly drying and heating cotton seed in a vacuum or any inert atmosphere, such as nitrogen, to prevent oxidation of the fats and proteins in the seed they will endure the temperature of boiling water for hours without affecting their vitality.

In fact we have heated the seed of Weber 49 variety of cotton for 26 hours without impairing their vitality and by this treatment have completely destroyed the fungous anthracnose. The seed so treated have a much higher percentage of germination than the untreated seed. Very highly infected seed of the Weber 49 variety were used in all our experiments. We are applying our method of treatment to other varieties of cotton seed and diseases carried by seed of other crops.

G. F. LIPSCOMB
G. L. CORLEY
UNIVERSITY OF SOUTH CAROLINA

MISUSE OF THE WORD "CREATION" BY NATURALISTS

THE word *creation* is sometimes used by naturalists in a sense that is not only inaccurate but which, even from the standpoint of the author's own belief, is actually misleading. I refer to its application *to the mode of origin* of animals or plants in a state of nature.

Such use of the word is objectionable for two reasons: (1) It implies a sudden coming into existence, ignoring ancestry; (2) it implies the act of a superior power, for how can there be a *creation* without a *creator?*

The proper meaning of the word as defined by leading lexicographers would seem to be free from ambiguity. Webster's definition is, "To bring into being; to cause to exist, said especially of the divine fiat by which the world is regarded as brought into being out of nothing." Similarly, the Century Dictionary definition is, "To bring into being; cause to exist; specifically to produce without the prior existence of the material used, or of other things like the thing produced; produce out of nothing." Both authorities take their first example from the Bible:

> In the beginning God created the heaven and the earth.

In reference to the origin of living organisms, does it not go without saying that the words *creation* and *development* (or *evolution*) convey diametrically opposite meanings—the one implying a sudden origin independent of ancestry; the other a gradual development from an antecedent form? Then why should one use *creation* when he means *development* or *evolution?*

In connection with the phantom of creation it may not be amiss to mention that the Mosaic conception of the origin of man as a definite act of a creator finds a close parallel in the beliefs of certain of our North American Indians. Thus, a California tribe holds that man was created by three deities—the Coyote, the Bear and the Lizard. Coyote wanted man to be fashioned after himself; Lizard objected, insisting that man should have five fingers like himself, so that he could take hold of things; while Bear maintained that man should have large flat hind feet in order that he might stand erect. So they compromised, Bear giving man his hind feet, Lizard his five fingers, Coyote his mental alertness.

This, like the Mosaic conception, pictures man as the result of a definite and deliberate act of creation. The circumstance that the Mosaic belief is monotheistic, the Indian belief polytheistic, is of no consequence from the standpoint of man's origin, both agreeing that he was created out of raw materials by a pre-existing deity or deities.

C. HART MERRIAM

STANDARDIZED NOMENCLATURE OF BIOLOGICAL STAINS

AT a meeting of manufacturers and dealers in biological stains in September, 1922, the committee in charge of the investigation of stains was asked to draw up a standardized list of the most commonly used stains indicating in each case both the preferred designation and the most commonly used synonyms. Such a list has now been prepared with the cooperation of the manufacturers and others interested in these stains. This list is hereby published as a step toward stabilizing the nomenclature of these products.

The list as given here is divided into two groups: first the stains which might be called staples and which are necessary in practically all biological laboratories; and secondly the less commonly used stains which are required only for special purposes. Manufacturers and dealers assure us that the bulk of the business is done with the stains on the first of these two lists.

The accompanying list of stains is not claimed to be anywhere near complete. There are many dyes sometimes used as stains for special purposes that are not included because

LIST OF ORDINARY STAINS

I. STAPLES

(a) *Synthetic dyes*

Schultz No.	Preferred Designation	Synonyms; and slightly varying shades
38	Orange G	Patent orange. Crystal orange. Wool orange. (Slightly differing grade: Orange GG, GMP)
124	Janus green B	Diazin green.
223	Sudan III	Scarlet G or B. Fettponceau G. Oil red. Cerasin red.
307	Congo red	Congo. Cotton red. Direct red. Cosmos red.
511-3*	Fuchsin, basic	Fuchsin. Diamond fuchsin. Magenta. Rubin. Rosanilin. Rosanilin hydrochloride. (Different grades sold under the name of fuchsin followed by various shade designations).
515	Methyl violet 2B	Methyl violet. Dahlia B. Paris violet. Gentian violet. Pyoktanin blue. (Slightly differing grades: Methyl violet B, BBN, BO and V3).
516	Crystal violet	Violet C, G or 7B. Gentian violet. Hexamethyl violet.
.....	Gentian violet†	
519	Methyl green	Double green. Light green.
524	Fuchsin, acid	Fuchsin S, SN, SS, ST or S III. Acid magenta. Acid rubin.
539	Anilin blue, water soluble	China blue. Soluble blue. Marine blue. Blackley blue. Cotton blue. Water blue. Berlin blue.
568	Pyronin	
587	Eosin, yellowish	Eosin. Water soluble eosin. Eosin Y, W or WS. (Various grades denoted as Eosin G, Y extra, S extra, J extra, B extra, GGF, 3J, 4J, KS, DH and JJF.
659	Methylene blue, Med., U.S.P.	Swiss blue. (Slightly different grades: Methylen blue BX, B, BG and BB).
670	Neutral red	Toluylene red.
679	Safranin O.	Safranin AG, T, MP, Y and G.

(b) *Natural dyes*

932	Cochineal	(The aqueous extract of the cochineal insect).
	Carmine	(The lake prepared by adding alum to cochineal).
	Carminic acid	(The active dye purified from cochineal).
938	Hæmatoxylin	(The ether extract of logwood).
	Hæmatein	(The dye formed on oxidation of hæmatoxylin).

* Apparently three different dyes, corresponding to Schultz numbers 511, 512 and 513, are sold as basic fuchsin. It is apparently the case that a different product is required as an indicator in the Endo medium from that required for staining; but conflicting statements have been received, and the matter needs investigation.

† Nearly synonymous with methyl violet; various mixtures of methyl and crystal violets sold under this name, generally with a high percentage of dextrin.

the call for them is small, although in some cases new developments in technic may cause a growing demand for them in the future. For this reason manufacturers and dealers in stains are not asked to list no other stains in their catalogs; but it is hoped that so far as their catalogs include the stains given in the accompanying list they will use the nomenclature here recommended. It is suggested that they use the two lists given here, with the Schultz number and as many synonyms as they care to employ and then as a supplementary list those stains which they have in stock but which are not included in this list.

In explanation of this list it must be remarked that wherever possible only one shade of any particular stain has been listed and the closely related shades are mentioned in the column of the table indicated for that purpose. This is done because in most cases it proves that only one or two of the various shades are of any special use as biological stains. It should further be explained that the Schultz number given in the first column refers to the fifth edition of Schultz's *Farbstofftabellen* published in 1920, except in the case of the last few stains in the table, which were listed in earlier editions of this publication but not in

II. LESS COMMONLY USED STAINS

Schultz No.	Preferred Designation	Synonyms; and slightly varying shades
4	Naphthol green	
6	Martius yellow	Naphthol yellow. Naphthalene yellow. Manchester yellow.
33	Chrysoidin Y	Chrysoidin. Brown salt R. Dark brown salt R. (Slightly different shades: Chrysoidin A, G, 2G, R, J, RE, JEE).
34	Chrysoidin R	Chrysoidin. Cotton orange. Cerotin orange. (Slightly different shades: Chrysoidin REE, RG).
112	Bordeaux red	True red B, P. Cerasin. Archelline 2B. Azo-bordeaux. (Various grades denoted as: Bordeaux B, BL, G, R extra).
138	Methyl orange	Orange III. Helianthin. Gold orange.
139	Orange IV	Orange N. Acid gold D. Tropæolin OO. Citronin V.
144	Orange I	Naphthol orange. Orange S. Tropæolin G, OOO No. 1.
145	Orange II	Gold orange. Orange A, P, G, R. Acid orange. Orange extra. Mandarin G. Tropæolin OOO No. 2.
168	Amaranth	Naphthol red. True red. Bordeaux. Bordeaux SF. Victoria rubin. Azo rubin. Wool red.
232	Sudan IV	Scarlet red. Fettponceau. Ponceau 3B.
247	Biebrich scarlet, water soluble	Ponceau B. Double scarlet. Scarlet EC.
283	Bismarck brown Y	Bismarck brown. Vesuvin. Phenylene brown. Manchester brown. Excelsior brown. Leather brown. (Slightly different shade: Bismarck brown G).
359	Trypan red	
363	Benzopurpin 4B	Cotton red. Dianil red. Diamin red. Sultan 4B. Direct red 4B.
391	Trypan blue	Diamin blue. Benzo blue. Dianil blue. Congo blue. Naphthamine blue. Benzamin blue. Azidin blue. Niagara blue.
493	Auramin	Pyoktaninum aureum. Pyoktanin yellow.
495	Malachite green	Emerald green. New Victoria green. Diamond green. Solid green. True green. New green. Light green N.
499	Brilliant green	Ethyl green. Solid green. Benzaldehyde green. Malachite green G.
505	Light green SF, yellowish	Light green 2G, 3G, 4G, 2GN. Acid green D, G, 5G, H, F, GB, GG, G extra, GW, OOO, O yellowish.
514	Hoffman violet	Dahlia. Iodine violet. Primula R. Red violet. Violet, R, RR, 4RN.
521	Spirit blue	Anilin blue, alcohol soluble. Gentian blue. Night blue. Lyons blue. Paris blue.
536	Alkali blue	
538	Methyl blue	Cotton blue. Wool blue. Helvetia blue.
555	Rosolic acid	Aurin.
555	Corallin, yellow	Sodium salt of rosolic acid.

the fifth edition. In such cases as this both the edition and the list number in that edition are given.

The list as it now stands is to be regarded as a preliminary one, subject to modification. In spite of all the advice received in preparing it, there are probably points in it still that are not correct. It is also obvious that the choice of preferred designation and the placing of any stain in either the first or the second list was more or less arbitrary and had to be a compromise between the various opinions re-

Schultz No.	Preferred Designation	Synonyms; and slightly varying shades
573	Rhodamin B	Rhodamin O. Brilliant rose.
585	Fluorescein, U. S. P.	Uranin.
588	Eosin, alc. sol.	
590	Eosin, bluish	Eosin BN, B, BW, DHV. Methyl eosin. Safrosin. Eosin scarlet B, BB. Scarlet J, JJ, V. Nopalin G. Cæsar red.
592	Erythrosin, bluish	Erythrosin B. Pyrosin B. Eosin J. Iodo-eosin. Dianthine B. (Slightly different shades: Erythrosin D, J, JNV, W).
597	Rose bengal	(Various grades denoted as: Rose bengal B, 2B, 3B).
621	Brilliant cresyl blue	Cresyl blue. Cresyl blue 2RN or 2BS.
653	Nile blue sulfate	Nile blue A.
694	Magdala red	Naphthalene red. Naphthylamine red.
697	Indulin, alc. sol.	Acetin blue. Azin blue. Solid blue.
698	Nigrosin, alc. sol.	Nigrosin B, BB.
699	Indulin, water sol.	(Various grades denoted: Indulin NN, N, N6, B, L, etc.).
700	Nigrosin, water sol.	Anilin gray. Steel gray. Indulin black. Gray R, B, BB. (Various grades denoted: Nigrosin DW, R, G, etc.).
777	Chromogen I	
788	Alizarin	(Various grades denoted as: Alizarin P, VI, Ie).
780	Alizarin red S.	Alizarin monosulphonate of sodium. Alizarin red WS. Alizarin carmine.
877	Indigo carmine	Indigotine.
934	Orcein	
I 276*	Lacmoid	Resorcin blue.
II 348	Thionin	Lauth's violet. (*Not* thionin blue, which is Schultz No. 661).
II 284	Iodine green	
IV 592	Toluidine blue O	
.....	Azur I†	Methylene azur.
.....	Azur II†	
.....	Methylen violet, Bernthesen	(*Not* methylen violet RRA or 3RA, Schultz No. 680).
.....	Cresyl violet	Cresyl echt violet.

* The Schultz number refers ordinarily to the 5th edition of Schultz' Farbstofftabellen. When the number is preceded by a Roman numeral, the dye in question is not listed in the 5th edition and the Roman numeral indicates the edition in which it is to be found.

† See U. S. Pharmacopœia, 9th Edition, p. 525.

III. COMPOUND STAINS*

Name	Reference
Azur-II-eosin	U. S. Pharmacopœia, 9th Edition, p. 525.
Balch's blood stain	Stitt, Practical Bacteriology, 6th Edition, p. 261.
Biondi-Ehrlich-Heidenhain triple mixture	Lee, Microstomists Vade-Mecum, 8th Edition, p. 173.
Ehrlich's triacid or triple mixture	Stitt, 6th Edition, p. 260.
Jenner's stain	Lancet, 1899, p. 370.
Leishman's blood stain	Stitt, 6th Edition, p. 261.
Tetrachrome blood stain (MacNeal)	Zinnser, Bacteriology, 4th Edition, p. 797.
Pappenheim's stain	Stitt, 6th Edition, p. 54.
Pappenheim's panoptic triacid stain	Lee, 8th Edition, p. 383.
Wright's blood stain	Mallory and Wright, Pathological Technic, 5th Edition, p. 364.

* The compound stains listed here are those which are commonly sold already compounded by manufacturers and dealers in stains, either in dry or in liquid form.

ceived. The future may show the desirability of changing some of these matters. Any suggestions along this line by readers of this article will be gratefully received.

It is hoped that both those who use and those who manufacture or handle biological stains will cooperate in this standardization, the latter by using the nomenclature in their catalogs and price-lists and the former by ordering stains by the names given here, specifying the Schultz number whenever one is listed.

COMMISSION ON STANDARDIZATION OF BIOLOGICAL STAINS.

GENEVA, N. Y. H. J. CONN
Chairman

SPECIAL ARTICLES

REVERSE MUTATION OF THE BAR GENE CORRELATED WITH CROSSING OVER

THE bar gene of Drosophila melanogaster reverts to its normal or wild-type allelomorph in from thirty to sixty individuals per hundred thousand (May 1917, Zeleny 1918, 1921, 1923). This is a far higher frequency of mutation than is shown by any other locus in Drosophila. We have now found that bar reversion shows a relation to crossing over in the bar region.

Zeleny (1921) found that bar reversions usually occur singly, so that it is not probable that the mutation occurs far back in the history of the germ-cells. It has been the experience of all who have studied bar stocks that in any given specimen the gonads and the eyes are of the same constitution—that is, that a bar-eyed fly breeds as a bar, and a round-eyed fly breeds as a not-bar. These facts further indicate that the bar reversion occurs either late in the history of the germ-cells, or else before the first cleavage division.

If reversion occurs in the germ-cells of both sexes with equal frequency homozygous stocks should produce twice as many heterozygous bar females as wild-type males; if it occurs only in females the number of heterozygous females produced should be equal to the number of wild-type males; if it occurs only in males the reverted offspring should all be heterozygous females. Zeleny (1923) has obtained from homozygous bar stocks a total of fifty-two heterozygous bar females and fifty wild-type males, thus indicating that reversion occurs only (or chiefly) in the germ-cells of females. We can confirm the absence of reversion in males, from extensive experiments in which bar males were mated to not-bar females, without the production of a single reversion.

In an attempt to determine whether the reversion of bar affects one or both chromosomes of a homozygous female, the following experiment was carried out. Females were made up that were homozygous for bar and for the sex-linked recessive eye-color eosin, and that carried a Y-chromosome. These females were also made up in such a way as to give "high" non-disjunction. Such females were mated to vermilion (not-bar) males. Disregarding gynandromorphs, mutations other than bar reversion and a few anomalous results probably due to non-virginity or to mutation, the following counts were obtained by Miss E. M. Wallace:

REGULAR OFFSPRING

red heterozygous bar ♀	eosin bar ♂	red not-bar ♀	eosin not-bar ♂
46518	40303	19	8

Percentage of reversions, .03

EXCEPTIONAL OFFSPRING

eosin homozygous bar ♀	vermilion not-bar ♂	eosin heterozygous bar ♀
12223	11440	1

Percentage of reversions, .008

These results, taken together with the facts previously outlined, at once suggested that bar reversion has something to do with crossing over, since the most striking difference between the regular and exceptional offspring of an XXY female is that the former include almost or quite the normal proportion of crossovers, while the latter are only very rarely crossovers (Bridges 1916). On this view the one eosin heterozygous bar female produced might be interpreted as an "equational" exception (in which case the experiment was inconclusive for the purpose for which it was intended).

The crossover suggestion has now been verified directly in two separate experiments. The two sex-linked recessives forked (f, locus 56.5) and fused (fu, locus 59.5) lie on opposite sides of the bar locus, but are only about three units

apart (Bridges 1921). In the first experiment ultra bar (B^u), an allelomorph of bar described by Zeleny (1920) was used. Zeleny has shown that homozygous ultra-bar stocks give rise to reversions to wild-type with about the same frequency as do homozygous bar stocks. In the present case females of the constitution $\frac{B}{f\,B^u\,fu}$ were tested. Three reverted offspring were produced in about 6,500 flies, thus indicating a reversion frequency for the heterozygote that is of about the same order as the frequency in homozygous bar or homozygous ultra-bar. All three of these reverted individuals arose from crossing over between forked and fused: one was forked not-fused and the other two were not-forked fused. In the second experiment ultra-bar was not used and forked and fused were in opposite chromosomes, *i.e.*, the females tested were of the constitution $\frac{B\,fu}{f\,B}$. Three reversions have so far appeared—two wild-type males and one forked fused male. Thus all six reversions in these experiments were accompanied by crossing over between forked and fused; yet such crossovers include only about three per cent. of the total number of individuals examined. It follows that *reversion of bar to normal is associated with crossing over at or near the bar locus.*

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THE ABSOLUTE VALUES OF THE ELECTRICAL MOMENTS OF ATOMS AND MOLECULES

SINCE an atom consists of a number of electrons distributed around a positive nucleus, its effect at an external point at a distance which is large in comparison with the diameter of the atom, is equivalent to an electrical doublet. The nature of the interaction of atoms or molecules in a gas or liquid must, therefore, largely correspond to that of electrical doublets. The writer has pointed out[1] that, since the doublets would tend to set themselves with respect to each other so that the potential energy is a minimum, attraction would be the outstanding force between the molecular doublets, and if repulsion occurs, it would be as small as possible. This is a different view than that taken by Debeye[2], who supposes that attraction is brought about by contractions and expansions of the molecular doublets on approaching and receding from each other, in such a manner that attraction is the outstanding force. But such changes, though probably occurring to a certain extent, need not necessarily exist in order that attraction may be the outstanding force. In any case, the determination of the absolute value of the average electrical moment associated with the atoms or molecules during their interaction in a substance is of outstanding importance.

In dealing with this problem the main difficulty is that the molecular collisions interfere with, or act in opposition to, the tendency of the molecular doublets to set themselves so that the potential energy is a minimum. The extent of this effect can not be calculated without introducing a number of assumptions. It is thus practically impossible to determine the moment of a molecule from data on the internal heat of evaporation of a liquid, the quantity most directly connected with the molecular moments. But this difficulty largely ceases to exist on considering the internal heat of evaporation at the absolute zero of temperature.[3] The average attraction between two molecular doublets in a substance in that case can be shown to be approximately given by

$$4\,\frac{M^2}{r^4},$$

where M denotes the moment of each doublet and r their distance of separation. The values of the internal heat of evaporation at the absolute zero can be exterpolated by means of the empirical latent heat equation

$$L = (\rho_1^2 - \rho_2^2)\,k$$

which is particularly well adapted for this purpose, where ρ_1 and ρ_2 denote the densities of the liquid and vapor respectively, and k a con-

[1] *Phys. Review*, xviii, 4, p. 303, 1921.

[2] *Phys. Zeit.* 21, p. 178.

[3] The details of these deductions are given in a paper in the course of publication in the *Journal of the Franklin Institute.*

stant which depends only on the nature of the liquid. It is a fairly straightforward process now to show that

$$L_0 = 8.42 \frac{\rho_0}{m_a^2} M^2$$

where L_0 denotes the internal heat of evaporation[4] at the absolute zero, m_a the absolute molecular weight of a molecule, and ρ_0 the density at the absolute zero, which has been exterpolated for a large number of substances by means of Cailletet and Mathias' linear diameter law. Using this equation, the writer has determined the electrical moments of the molecules of a number of substances and found that they were approximately given by

$$M = 10^{-19} \Sigma N^{2/3},$$

where N denotes the atomic number of an atom. It appears, therefore, that the moment of a molecule is equal to the sum of the moments of its atoms, and that the moment of an atom is proportional to the two thirds power of its atomic number which is equal to the number of elementary electrical charges of one sign the atom contains. This result may be taken as good evidence that the molecules of a substance largely interact as if they consisted of electrical doublets.

If x denotes the distance between the charges of the representative doublet of an atom, we have

$$x N e = M$$

or

$$x = 2.09 \times 10^{-10} N^{-1/3} \text{ cm.}$$

Thus the value of x decreases as the atomic weight increases, which is probably owing to the fact that the larger the number of electrons in an atom, the more symmetrically they may be distributed around the positive nucleus. Moreover, x is also always less than the diameter of the atom, as we might expect. The value 2.09×10^{-10} c.m. of x for the hydrogen atom is much smaller than the value of $.53 \times 10^{-8}$ c.m. of the radius of the circle the moving electron describes around the positive nucleus according to Bohr's theory. Thus in order that the atom may behave as an electrical doublet it is necessary that the nucleus does not occupy the center of the circular path of the electron, but a distance of about 2.09×10^{-10} c.m. from the center at right angles to the plane of motion. Strictly the system will not be in equilibrium by itself under these conditions, but may be when associated with another system. If the electron describes an ellipse with the nucleus at one of the foci, the atom may behave on the whole as a doublet when isolated. The doublet effect of more complicated atoms may be produced along similar lines.

[4] In ergs per gram.

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SIMPLE MILK FORMULAE[1]

CERTAIN formulæ[2] obtain in milk analysis. Among these are:

Fleischmann's:

The mean specific gravity of the milk solids $= \dfrac{T}{T - \dfrac{100G - 100}{G}}$

where T = per cent. of total solids.
G = specific gravity of the milk.

Babcock's (Hehner & Richmond's):

The per cent. of total solids $= 0.25L + 1.2F$,
where L = lactometer reading $= 10(100G - 100)$
F = per cent. of fat.

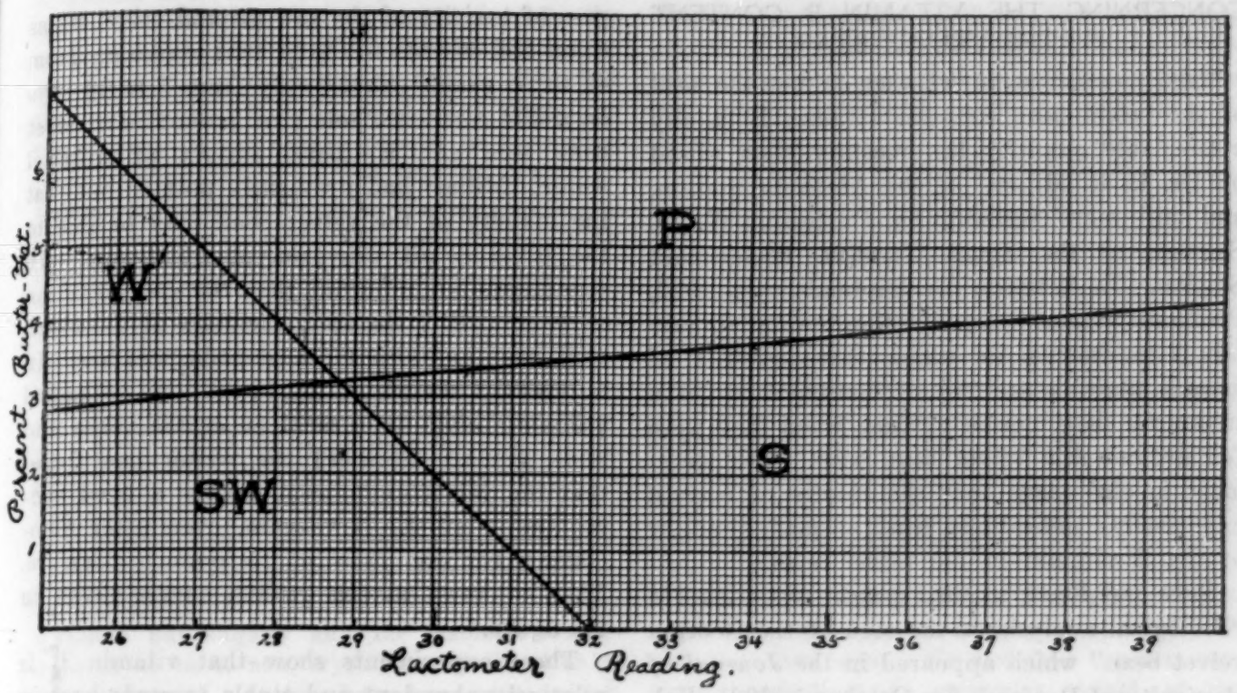
Bialon's:

The specific gravity of the fat-free milk $= \dfrac{100G - F}{100 - \dfrac{F}{0.933}}$

Certain numerical limits in these formulæ are generally recognized: the mean specific gravity of the milk solids does not exceed 1.34 in herd milks above suspicion of skimming,[3] and the

[1] Abstracted from a paper read before the Delaware County Institute of Science, Media, Pennsylvania, May 9, 1921.

[2] More or less adequate discussion of one or more of these milk formulæ are to be found in Bulletin 134, U. S. Dept. Agriculture, Bur. Animal Industry (by Shaw and Eckles) and in books relating to milk control, such as those of Leffmann, Ernst-Mohler-Eichhorn, Barthel, Van Slyke, Race, Jensen-Pearson, Heineman, and particularly in that of Richmond. Books on food analysis, such as those of Leach, Woodman and Allen, also take up milk formulæ more or less completely.



specific gravity of the milk free from fat does not fall below 1.0323 in milks above suspicion of watering.[4] The formulæ given above are not directly connected with the two values that are determined first in a routine milk examination, namely, the specific gravity, G, and the percentage of fat, F. Rules that show F as a function of G are needed, for these two values are the logical bases upon which to sort out milks above suspicion of skimming and watering. This paper calls attention to such rules:

Rule I. Add 3 to the lactometer reading, and then divide by 10. The result is the minimum percentage of fat to be expected in that milk if it is above suspicion of skimming.

Rule II. When lactometer readings from 26 to 30 are arranged in ascending order, the corresponding minimum percentages of fat in herd milks above suspicion of watering are whole numbers arranged in descending order from 6 to 2.

Rule 1 is derived as follows: Put the limiting value (1.34) for unskimmed herd milk into Fleischmann's formula; substitute for percentage of total solids, T, in Fleischmann's formula this same value as it is defined by Babcock's formula; and solve for an equation representing $F = (f)G$. This will be found to be

$$F = \left(\frac{3.284}{G} - 2.083\right)(100G - 100) \quad \ldots \quad (4)$$

Using in (4) known values of G between the usual limits, namely, 1.025 to 1.040, and solving for F, a table of values is gotten that shows Rule I clearly, and also shows that Rule I gives values for F within about 0.02 per cent. of those calculated by equation (4).

Rule II is derived as follows: Put the limiting value 1.0323 for unwatered herd milks into Bialon's formula, and solve for an expression representing $F = (f)G$. This expression will be found to be

$$F = 969.927 - 939.579G \quad \ldots \quad (5)$$

Using in (5) known values of G between the limits 1.026 and 1.030 and solving for F, a table of values is gotten that shows Rule II clearly, and also shows that Rule II gives values for F within 0.1 per cent. on the average when compared with those calculated by equation (5). As 0.1 per cent. is approximately the average error in the routine determination of butter-fat in milks, this may be neglected.

Plotting Rules I and II gives a diagram that covers the values of F and L met with in routine work, and that shows the region where the two rules overlap.

These simple rules are recommended as guides in sorting out early in the examination of any number of herd milks those that are above suspicion of skimming and watering.

DAVID WILBUR HORN

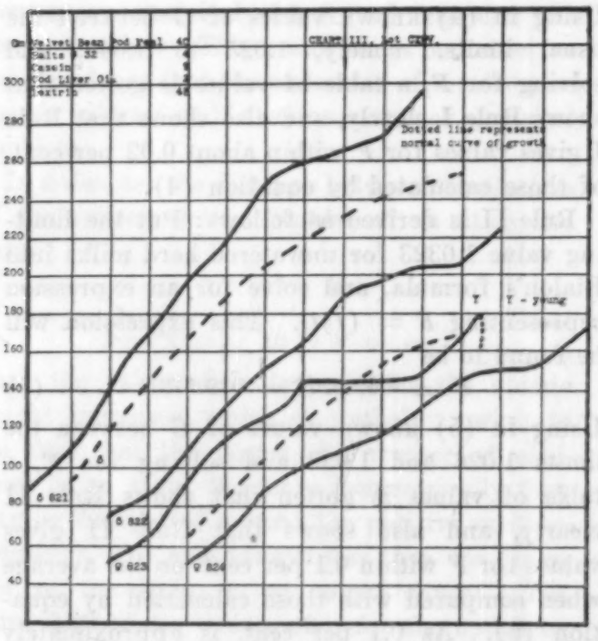
[3] Woodman: "Food Analysis," New York, 1915, p. 139.

[4] Barthel: "Die Methoden z. Untersuchung v. Milch u. Molkereiprodukten," Leipzig, 1911, p. 135.

CONCERNING THE VITAMIN B CONTENT OF THE VELVET BEAN

THE question as to whether or not the seed of the velvet bean contains vitamin B in any appreciable quantity has recently been raised by Dr. E. R. Miller,[1] of the Alabama Station, and still more recently by Professor W. D. Salmon, of the South Carolina Experiment Station. In SCIENCE for September 29, 1922, Professor Salmon reports the results of certain experiments in which three groups of mature pigeons suffered ill consequences in a strikingly short period of time when they were fed ground raw velvet bean seed. The statement is also made that the results of certain experiments indicate at least a small quantity of the B vitamin in the velvet bean.

Sure and Read, in their paper reporting the "Biological analysis of the seed of the Georgia velvet bean" which appeared in the *Journal of Agricultural Research* for October 1, 1921, Vol. XXII, No. 1, called attention to the high degree of toxicity of the raw ground velvet beans when fed to rats. Young rats weighing from 40 to 90 grams existed only from 7 to 12 days on a diet composed solely of ground raw velvet bean seed and a liberal supply of distilled water. Miller[2] had previously pointed out that the toxicity of the velvet bean may be due to the presence of dihydroxyphenylalanine. In our paper we reported that the concentration of vitamin B in the seed, exclusive of the tough seed coats and also the seed pods, was low. In a recently completed study of the biological value of velvet bean meal (*i. e.*, the beans and pods ground together) the writer has found that the velvet bean meal carries a good concentration of the B vitamin, even after autoclaving for one hour at 15 pounds pressure. This is shown in the growth curves given in the figure.



This chart shows the growth of young rats on a ration carrying 40 per cent. autoclaved velvet bean meal as the only source of vitamin B. This ration contained all the other dietary essentials in satisfactory amounts.

These experiments show that vitamin B is relatively abundant and stable towards heat in the thick seed pods of the velvet bean, but is of rather low concentration in the seed.

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[1] Do velvet beans contain Vitamin B? Paper presented by Dr. Miller before the Division of Agricultural and Food Chemistry at the April (1922) meeting of the American Chemical Society, Birmingham.

[2] Miller, Emerson R., "Dihydroxyphenylalanine, a constituent of the velvet bean," *Jour. Biol. Chem.*, V. 44, No. 2, p. 4[illegible]-486, 1920.

THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF ORGANIC CHEMISTRY. III.

New methods of splitting pyrimidines. The action of hydrogen peroxide and of sodium pentacyano-aquo-ferroate on thymine: OSKAR BAUDISCH and LAWRENCE W. BASS. Previous experiments have shown that the system $FeSO_4$ + $NaHCO_3$ + air splits thymine with the formation of urea, acetol and pyruvic acid. The observation was made that the same products are obtained, but in different quantities, by using hydrogen peroxide, either alone or with traces of ferrous salts. The splitting of thymine by sodium pentacyano-aquo-ferroate yields pyruvic acid alone or pyruvic acid with traces of acetol. These facts are important for explaining the mechanism of the reaction.

New methods of splitting pyrimidines. The action of iodine solution and sodium bicarbonate on thymine: OSKAR BAUDISCH and LAWRENCE W. BASS. By the action of an aqueous solution of iodine and potassium iodide in the presence

of sodium bi-carbonate, the pyrimidine ring can easily be split under mild conditions. In the case of thymine the products obtained are urea and acetol; no pyruvic acid is found. The fact that pyruvic acid is not formed is of special interest, since it was always present as a reaction product when the split was brought about by $FeSO_4 + NaHCO_3 +$ air, by H_2O_2 alone or with ferrous salts, or by sodium pentacyano- aquo-ferroate.

The action of diazomethane on cyclic ureides: A. J. HILL and F. H. CASE. With the object of throwing light on the linkage of the pyrimidine constituents in nucleic acids, both the former and the latter types of compounds are being investigated in regard to their behavior towards the methylating agent diazomethane. Uracil, thymine and 4-methyl uracil, suspended in ether solution and treated with diazomethane, dissolve completely and each yields the corresponding dimethyl derivative. On the other hand, cytosin dissolves but slightly and the insoluble residue appears to be a new crystalline modification of this compound. It has been necessary to synthesize the hitherto unprepared 2-oxy-6-methyl-amino pyrimidin in order to assist in the identification of the ether soluble product in the cytosine methylation.

Local anesthetics of the holocaine type: A. J. HILL and I. RABINOWITZ. This investigation was undertaken for the purpose of increasing the efficiency and lessening the toxicity of the local anesthetic "holocaine," $(CH_3)\text{-}C\text{-}N(C_6H_4OC_2H_5)$ $\|$ $NC_6H_4OC_2H_5$ by systematic modifications of its molecular structure at the positions indicated by the bracketed portions of the above formula. In the types of compounds thus far prepared methyl has been replaced by aliphatic groups, such as ethyl and propyl, and by the aromatic benzyl. A new method has been developed for the synthesis of "holocaine," which depends upon the interaction of p-phenetidine and the hydrochloride of acetimino-ethyl ether.

The catalytic decomposition of glycerides: FRANCIS L. SIMONS and TREAT B. JOHNSON. Several simple triglycerides have been decomposed over ThO_2 at varying temperatures (350°-650°), and the composition of the products formed determined quantitatively. At the lower temperatures apparently a straight degradation of the glyceride into acrolein, fatty acid and small amounts of the di- and mono-glyceride takes place; higher temperatures favor the formation of more complex compounds. A new method of handling fatty acids (analytically) being developed in this laboratory by Dr. Donleavy has been given practical application in this work and found to work successfully. The investigation is still in progress and it is hoped that sufficient data will be uncovered to permit us to establish the general mechanism of these interesting decompositions.

The biochemical importance of the system: formaldehyde, ammonia and prussic acid: T. B. JOHNSON and H. W. RINEHART. A thorough investigation of the reactions occurring when formaldehyde, ammonia and prussic acid are allowed to interact is essential to an accurate understanding of the primary reactions taking place in plant growth. One substance formed by interaction of these three reagents is "methylene-aminoacetonitrile" $CH^2{:}NCH_2CN$. This is formed under conditions which are not well understood, and it has been reported in chemical literature that this substance can exist in isomeric modifications. Only one of them has received attention. Data has already been obtained which indicates that the isomerism is probably not physical isomerism. We find that the statements made regarding the molecular weight of these isomers is inaccurate. Furthermore, practically nothing has been published giving a true picture of constitution. We find that each compound is characterized by its crystalline habit. They are trimolecular compounds and are so constituted structurally as to reveal the presence of free cyanide groups. In many ways, they exhibit the properties of plant alkaloids. More work is in progress and an effort is being made to establish a constitutional formula.

The hydrogenation of several pyridine derivatives: T. B. GRAVE and E. EMMET REID. Prolonged shaking with hydrogen under 3 atmospheres pressure in presence of platinum black hydrogenates 1-methyl-2-pyridone only to the tetra-hydro. The same has been found true of 2-amino-pyridine in a variety of solvents. When the hydrogenation is pushed further there is decomposition with elimination of ammonia. Tetra-hydro-2-amino-pyridine is unstable and readily breaks up when set free from its salts by alkali. It gives tests for the primary amino group, but does not react with nitrous acid. 2-methyoxy-pyridine is hydrogenated directly to piperidine with loss of the methyoxy group.

The alkylation of benzene: T. M. BERRY and E. EMMET REID. Benzene has been alkylated by passing propylene in presence of aluminum chloride with high speed stirring. The isopropyl group is readily introduced in this way with the formation of mono and the poly-isopropyl-benzenes. The most of these up to the tetras have been isolated and identified. The isopropyl

group can be introduced into toluene and napthalene by the same means.

Organic mercury compounds related to triphenylmethane dyes and azo dyes: E. R. HANSON, G. J. LEUCK and F. C. WHITMORE. Preliminary paper. Direct mercuration of triphenylmethane dyes has been found to be very difficult. The process takes place more readily in the aurin series than in the rosaniline series. A large number of soluble mercurated azo compounds have been obtained by coupling diazonium salts from aminobenzoic acids, sulfanilic acid, naphthionic acid and a number of amino dye intermediates with ortho mercurated phenol and with dimercurated para cresol. In the first case the coupling takes place in the para position, leaving the mercury group unchanged. In the second instance one of the mercury atoms is replaced during the coupling.

Reaction of organic mercury compounds with non-metal halides: NEAL THURMAN and FRANK C. WHITMORE. Preliminary paper. Of a very large number of halides studied the first to give clean-cut results was para toluene sulfone iodide which gives a good yield of para ditotlyl sulfone with para mercury ditotlyl. In most cases the organic mercury compound does not act with the halide except under conditions which lead to complete decomposition. Tertiary iodides yield organomercuric iodides and olefins.

The electrolytic reduction of maleic, fumaric and cinnamic acids, and the electrolytic production of amino salicylic acid: JAMES F. NORRIS and E. O. CUMMINGS. The fumaric and maleic acids furnish about 90 per cent. of the theoretical yield of succinic acid when reduced electrolytically. The yield of hydrocinnamic acid under the proper conditions is also about 90 per cent. of the theoretical. The product formed by condensing benzene diazonium chloride with salicylic acid was converted with a good yield into amino salicylic acid when titanium chloride was used as a catalyst. The production of this acid was accomplished more readily by reducing the diazonium compound with titanium chloride and regenerating the latter electrolytically.

The influence of environment on the reactivity of a chlorine atom: JAMES F. NORRIS and CLIFFORD BANTA. The rates at which diphenyl chloromethane and several of its substitution products react with alcohol have been determined. The reaction was followed by the measurement of the conductivity of the hydrogen chloride formed as a result of the reaction. The compounds were selected because the reactions involved are reversible and proceed at such rates that the latter can be measured at 25 degrees. The velocity constants of the opposing reactions in the case of some of the compounds are as follows:

$(C_6H_5)_2CHCl + HOC_2H_5 \; K_1 \; (C_6H_5)_2CHOC_2H_5 + HCl$

	K_1	K_2	K_2
$(C_6H_5)CHCl$	$.0_31205$		.001495
p Chlor.	$.0_45176$		$.0_27240$
p Me	$.0_22491$		.2657
p Phenyl	$.0_41546$		$.0_21278$
o Chloro	$.0_51170$		.05109

Characteristics of two crystalline forms of glycine: C. A. BRAUTLECHT and N. F. EBERMAN. Investigations of glycine have shown a number of physical and chemical differences. Emil Fischer, Ber. xxxviii, 1914 (1905) noticed that the plate and needle forms of glycine reacted differently to phosphorus pentachloride and acetyl chloride mixtures. He made no explanation of the difference. Ostromisslensky, in 1908, reported that one form of glycine precipitates one form of *l* asparagin from saturated solution, while the other does not. Some investigators consider glycine crystals as belonging to hemihedral division of the orthorhombic system, while others consider them as belonging to the monoclinic system. Various investigators then concluded that glycine might exist with the inner ammonium structure, especially when in solution. Further experimental evidence was therefore considered desirable to arrive at an understanding of the chemistry of glycine, a substance of basic importance both from the pure organic and biological chemical viewpoint. Following the suggestions offered by Falk and Seguira, *J. Biol. Chem.*, xxxiv, 29 (1918), who studied the action of bromine on the two crystalline forms of glycine, the authors of this paper report the results of melting temperature determinations of several samples of the two forms, alone and in mixtures, the action of heat, dry and moist hydrogen chloride, dry and moist sulfur dioxide, dry and moist bromine and acetyl and phosphorus chlorides on the two crystalline forms of glycine. The conclusions reached are that there is no chemical difference between the two crystalline forms of glycine in the dry state, and that in Fischer's experiments acetyl chloride, in presence of phosphorus pentachloride, reacted in a complicated manner.

Some substituted aryldialkyl amine oxides: LAUDER W. JONES and ELDER B. HARTSHORN. Meta and para nitro dimethyl aniline and para brom-dimethylaniline were oxidized by Caro's acid to the corresponding amine oxides, and isolated as sulfates. Other characteristic salts were prepared, the hydroiodides partially undergoing spontaneous intramolecular oxidation and reduction to the amine, iodine and water. Their stability seems to be a measure of the firmness

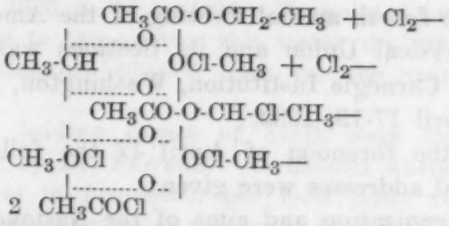
with which the oxygen is bound to the nitrogen. The free bases prepared by the action of silver oxide on the hydrochloride do not react with methyl iodide to form stable addition products as do the trialkyl amine oxides.

Studies in cellulose chemistry (Part 8). Use of acetylene for the synthesis of cyclic acetals: HAROLD SANFORD HILL and HAROLD HIBBERT. By adding small amounts of conc. sulfuric acid and mercuric sulfate to a polyhydroxy derivative (glycols; glycerine) and passing acetylene into the mixture at temperatures ranging from 20° to 50°C. good yields of the corresponding cyclic acetals are obtained. The best results are found when very vigorous agitation is employed. This method is being applied to other poly-hydroxy derivatives.

Studies in cellulose chemistry (Part 9). Partition experiments in the formation of cyclic acetals: HAROLD SANFORD HILL and HAROLD HIBBERT. The method outlined in the previous abstract has been used to determine the nature of the partition in the formation of cyclic acetals comprising both five and six-membered rings. Using a mixture of one mole of a 1:2 and a 1:3 glycol and passing in only enough acetylene to combine with one of the glycols, it was found, in agreement with the previous work of Hibbert and Timm on this subject, that the tendency toward six-membered rings formation is much more pronounced than that of five.

Studies in cellulose chemistry (Part 10). The action of traces of iodine on organic esters: HAROLD HIBBERT. The study of polysaccharides is concerned with the properties of the hydroxyl and carbonyl groups, especially under the influence of catalysts. Unfortunately we are still quite in ignorance as to the mechanism of such fundamental reactions as the polymerization, condensation and halogenation of aldehydes, ketones and related compounds. Up to the present no explanation has been given to the mechanism involved in the ready transformation of aldehydes into esters under the influence of traces of aluminum alkylates (Tishchenke), a change evidently closely related to the Cannizzaro reaction. A consideration of the mechanism involved in such ester formation, as well as that relating to the halogenation of organic esters, leads to the conclusion that both are intimately related.

Studies on cellulose chemistry (Part 11). The action of chlorine on organic esters: RALPH S. MONTONNA and HAROLD HIBBERT. No satisfactory explanation has been given of the ready transformation of benzyl benzoate into benzoyl chloride under the influence of chlorine. Authors' experiments on the chlorination of ethyl acetate indicate the reaction takes place in the following stages:



Evidence is being accumulated with a view to showing that all alpha chlor-esters (III) exist as cyclic rather than as open chain compounds.

Tuberculinic acid—the nucleic acid of tubercle bacilli: ELMER B. BROWN and TREAT B. JOHNSON. Large amounts of tubercle bacilli, consisting of human and bovine types, have been subjected to analysis and hydrolysis and the nucleic acid purified and analyzed. An acid hydrolysis of this acid (tuberculinic acid) has revealed the presence of thymine and cytosine as normal pyrimidine constituents. Repeated examination has failed to reveal the presence of uracil. The usual purines, guanine and adenine are also present. An examination of the hydrolysis solution has produced evidence which proves that a hexane sugar functions in this nucleic acid molecule. Both formic and lævulinic acids have been identified, being produced in large amounts. Only very small amounts of furfuraldehyde are produced on hydrolysis.

Salts of pseudothioureas and their application in the identification of organic acids: J. J. DONLEAVY and T. B. JOHNSON. In the course of investigations dealing with the chemistry of fats, and the determination of structure of salts of pseudothioureas, it has been found that certain of these organic bases are characterized by their property of forming well-defined crystalline salts with the common organic acids. The salts so far examined are unique in that they are easily obtained in crystalline form, have definite melting points and serve admirably for purposes of identification. Thus far benzyl pseudothioureas has been the base which has received the most attention. It seems very probable that an analytical procedure may be developed through the use of these salts which will simplify our present methods of analyzing mixtures of organic salts.

The catalytic decomposition of formic acid: C. J. ENGELDER and B. B. WESTCOTT.

The electronic conception of valence and heats of combustion of organic compounds: M. S. KHARASCH and B. SHER.

CHARLES L. PARSONS,
Secretary

THE AMERICAN GEOPHYSICAL UNION AND ITS SECTIONS

THE fourth annual meeting of the American Geophysical Union and its Sections was held at the Carnegie Institution, Washington, D. C., on April 17-19, 1923.

In the forenoon of April 17 the following general addresses were given:

"Organization and aims of the National Research Council" by Dr. Vernon Kellogg, permanent secretary of the Council.

"The organization and work of the International Research Council" by Dr. R. A. Millikan, a delegate to the Brussels meeting in 1922.

"The organization and aims of the American Geophysical Union" by the chairman of the Union, Dr. L. A. Bauer.

"The organization and aims of the National Geodetic and Geophysical Committee of Canada" by a delegate from Canada, Mr. Noel Ogilvie, superintendent of the Geodetic Survey of Canada.

On the afternoon of April 17, a statement was made by the representative of each of the sections of the union, *i.e.*, geodesy, seismology, meteorology, terrestrial magnetism and electricity, oceanography, volcanology and geophysical chemistry. The statements covered the status, scope and problems of science represented by the several sections.

On the evening of the seventeenth a banquet was held at which addresses were made by Congressman H. W. Temple on "Economic value of governmental scientific work" and Dr. E. E. Slosson on "Science and the public." Remarks were made on international and national work in geophysics by Colonel E. Lester Jones, director of the United States Coast and Geodetic Survey; Captain Frederic Bassett, hydrographer of the United States Hydrographic Office, and Professor C. F. Marvin, chief of the United States Weather Bureau.

Meetings were held by the seven sections of the union on April 18 and the forenoon of April 19, at which a total of forty-nine scientific papers or communications were presented. It is expected that abstracts of these papers will appear in the printed proceedings of the annual meeting of the union.

In the afternoon of April 19, there was a general business meeting of the whole union at which reports were received from the officers of the union, of the sections and of the committees. After discussion a number of resolutions dealing with scientific questions were adopted. The most important of these resolutions and one which is of special interest to the scientific public reads as follows:

Whereas, the United States Statutes at Large, Vol. 37, p. 913, provide that

"Hereafter the executive shall not extend or accept any invitation to participate in any international congress, conference or like event, without first having specific authority of law to do so,"

And, whereas, since other provisions of law make it impossible for officers of the government to attend and participate in an official capacity in any international foreign congress, convention, meeting or gathering, thus greatly embarrassing the scientific departments of the government in conducting the important duties and responsibilities devolving on them, and since the principal object of such congresses, conventions, meetings or gatherings is to secure between nations the most effective and profitable cooperation in scientific matters;

Therefore, be it resolved that the American Geophysical Union recommend to the National Research Council that appropriate action be taken to present to the Congress of the United States the disadvantages resulting from the effects of the laws referred to above, with the object of securing the necessary legislation permitting the executive and the heads of the various departments to designate duly accredited representatives to attend international foreign scientific congresses, conventions, meetings or gatherings. This legislation should apply especially to meetings of the International Research Council and its branches and the International Meteorological Committee and like organizations.

In response to an invitation from the chairman of the union, the following representatives of Canada attended and took part in the annual meeting of the union and its sections: Mr. Noe Ogilvie, superintendent of the Geodetic Survey; Dr. W. Bell-Dawson, superintendent of Tidal and Current Surveys; Mr. J. Patterson, meteorologist, Meteorological Service.

A list of the titles of papers read at any of the section meetings can be obtained by communicating with the secretary of the union at the United States Coast and Geodetic Survey, Washington, D. C.

WILLIAM BOWIE
Secretary
AMERICAN GEOPHYSICAL UNION

SCIENCE NEWS

PUBLIC HEALTH IN THE UNITED STATES

PROGRESS in public health in the United States which has lengthened the average life by fifteen years since 1870 and has greatly reduced the amount of infant mortality, tuberculosis, typhoid, small-pox, etc., while being unable so far to prevent an increase in the degenerative diseases of later life, was reviewed by Dr. Livingston Farrand, president of Cornell University, in the annual Sigma Xi lecture given at a joint meeting with the American Association for the Advancement of Science at Boston on December 27.

In discussing the world problem of re-establishment of social, economic and political order, Dr. Farrand emphasized the importance of human vitality as a fundamental factor in the process. The undermining of vitality in Europe as a result of the war and particularly of the child population has served to draw attention as never before to the problem of public health. It is now possible to review the situation in the United States and the survey offers certain striking figures. The observations of the 1920 census show that the average length of life in this country is now fifty-six years, said Dr. Farrand. This shows an increase of 3¼ years in the expectation of life since 1910, and had it not been for the influenza epidemics of 1919 and 1920 the increase would doubtless have been greater. The best available figures indicate a lengthening of the average life in this country by 15 years since 1870 and is eloquent testimony to the value of the researches of Pasteur and his successors to which this result is largely due.

Dr. Farrand also cited figures from the leading countries of Europe showing that America now compares favorably with the older nations. The highest figures available for any country are those of New Zealand, where the average life is about 60 years. This is contrasted with civilization like that of India, where no advance has been shown during recent decades and the average remains only about 24 years.

The speaker quoted with approval the resolution of the American Public Health Association at its recent annual meeting in which it stated the conviction that with no further additions to our knowledge of the causes and prevention of disease it will be possible during the next half century to add at least 20 years to the span of life.

Dr. Farrand also cited the reduction in the general death rate in the original registration states (New England and adjoining states) from 17 in 1900 to 14 in 1920. He pointed out that applied to the country this means the saving of approximately 400,000 lives for the year 1920 alone.

The leading causes of death were then reviewed by Dr. Farrand. He showed where great progress in prevention has been made and the chief problems which remain to be solved.

In the encouraging group he mentioned infant mortality, tuberculosis, typhoid, the infectious diseases of childhood and small-pox. He showed that in the last twenty years infant mortality has been reduced over one third; the tuberculosis death rate cut in half; typhoid deaths have been lowered by 80 per cent.; diphtheria, scarlet fever and measles have been greatly reduced and small-pox practically eliminated.

The unconquered diseases on the other hand offer a more disquieting picture. The death rate from cancer has steadily increased during the last twenty years. In 1900 it was 63 per cent. per 100,000 population; in 1920 it had risen to 83.4 per cent.

Similar increases are shown in diseases of the heart and kidneys. Heart diseases now cause more deaths than any other disease in the United States, the rate being 186.2 in 1920 as compared with 128.1 in 1900. It was pointed out that with the control of the communicable diseases of early life an increase in the degenerative diseases of later life is inevitable and that field is now an outstanding public health problem.

Dr. Farrand then outlined the organized movements in this country for the improvement of the public health and mentioned as particularly notable the Framingham demonstration under the auspices of the National Tuberculosis Association and the proposed demonstration of the Milbank and Commonwealth Funds of New York in the fields of tuberculosis and child health.

THE DIAMETER OF ATOMS

PROFESSOR THEODORE W. RICHARDS, of Harvard University, speaking at a symposium on the progress of chemistry at the Boston meetings, explained an entirely new method of estimating the diameters of atoms.

After showing several lantern slides which depicted the relative sizes of atoms, magnified two hundred million diameters, Professor Richards drew attention to the fact that a given atom has not always the same bulk in different substances.

Much interest now attaches to the reason for this change of bulk. In Professor Richards's

opinion, the chief reason is the fact that under different conditions atoms are subject to very different pressures from the several mutual affinities which bind them together. Hence the bulk depends upon the properties: compressibility and internal pressure. After calling attention to his earlier estimates of atomic diameters, which were avowedly only first approximations, he proceeded to explain an entirely new and far more satisfactory method, which depends upon the actual compressibilities of the elements as determined partly by Professor P. W. Bridgman and partly by himself. After showing that sodium conforms to almost exactly the same law of compression as does potassium, except for the fact that sodium is (in its ordinary state) under much the greater internal pressure, he was able to infer the volumes which potassium would occupy under far greater pressures. With these values as his numerical basis, and with similar reasoning concerning chlorine and bromine, he was able to infer, with small likelihood of error, how the contraction which occurs during the formation of common salt (for example) is distributed between the sodium and chlorine. The results throw much light also on the mechanism of chemical combination, the magnitude of the internal pressures involved and many allied phenomena. They furnish a remarkable mathematical confirmation of his theory of compressible atoms. This theory has rested heretofore mainly upon argument, which, although comprehensive and incontrovertible, was chiefly of a statistical rather than of a mathematical nature.

ELECTRIC AND HEAT WAVES

PHYSICISTS have finally succeeded in bridging the gap between the electric wave and heat-wave spectra by obtaining electric waves as short as the longest heat waves, and by detecting heat waves with electric wave receivers.

Dr. Ernest Fox Nichols, director of pure science at the Nela Research Laboratories at Cleveland, and Dr. J. D. Tear, assistant physicist at the same laboratories, announced in a paper presented to the American Physical Society meeting last week in Boston that by the aid of newly designed and more sensitive instruments and improved methods of experimentation they have succeeded in generating, receiving and measuring electric waves half a millimeter or one fiftieth of an inch in length. For comparison the ordinary radio transmission is by electric waves of the order of half a mile long.

Rubens and Von Baeyer in 1911 obtained heat waves one third of a millimeter long from a quartz mercury arc. The shortest electric waves just obtained are, therefore, of about the same length as the longest waves sent out by hot bodies.

As a latest proof of the identical character of light, heat and electric waves, Dr. Nichols and Dr. Tear have succeeded in using two different types of electric wave receivers to detect and remeasure Rubens' and Von Baeyer's long heat waves.

As a by-product of the investigation, the long wave emission from the quartz mercury arc has been found partially polarized, a fact which throws new light on the activity of the ions which emit this long wave radiation. Dr. Nichols and Dr. Tear have also found that the radiation can be isolated from the complex total emission of the mercury arc by simply sifting it through two thicknesses of black paper, thus avoiding the elaborate focal isolation method and apparatus previously thought necessary to accomplish this separation.

Dr. Nichols was president of the Massachusetts Institute of Technology from March to November, 1921.

THE TRACKS OF ATOMS

DR. R. W. RYAN and Dr. W. D. Harkins, of the University of Chicago, presented a paper before the American Physical Society at Boston in which they announced that they had obtained ten thousand photographs showing the tracks produced by atoms shooting through air at a speed thirty thousand times faster than that of the swiftest rifle bullet.

"It is of interest," said the paper, "that the atoms of helium usually shoot *directly through* half a million atoms of the air without hitting the central part of the atom which alone is heavy enough to deflect the helium atom from its path. Thus it is clear that atoms instead of being incapable of penetration, as was taught twenty years ago, are highly penetrable to other atoms if they shoot fast enough.

"The most interesting feature of the present photographs may be made clear by describing the most interesting of all the thirty or forty thousand atom tracks photographed. In this a helium atom moves about an inch straight through about an inch of air and directly through about 100 thousand atoms, then by accident it hits the center or nucleus of an atom of nitrogen. The helium atom rebounds almost directly backward at a velocity of about 20,000 times that of a rifle bullet, while the nitrogen atom is knocked directly forward at about two thirds of

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Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to **thirty** students, fee $100. Applications should be made to the Dean's Office.

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Dean, Yale University School of Medicine

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WAR ON INSECTS RAGES; MAN WINS SLOWLY

Science Service

WARFARE against insect pests grows in intensity, and despite the efforts of scientists, the damage mounts as new kinds of these enemies multiply and spread throughout the country, according to the annual report of the secretary of agriculture. Although the direct insect attack on crops has not been stopped, great progress has been made in the control of the indirect attacks made by these pests in carrying infectious diseases from plant to plant.

"Much of the failure in controlling some of the physiological diseases of potatoes and other cultivated crops," the report of Secretary Wallace says, "is now known to be due to failure to recognize the fact that plants might be infected and capable of transmitting the diseases without showing external symptoms. Researches have now thrown much light on a field in which scientific workers were previously almost helpless."

The direct attacks by the corn borer, the Japanese beetle, the cotton boll weevil and the pink bollworm have not been combatted with such success, the report revealed. The corn borer holds the ground previously gained, although a benevolent parasite has been introduced from France which laboratory studies indicate may prove of immense value in destroying various species of borers.

The Japanese beetle continues to spread at the rate of five miles a year and larger jumps may be made any time. It is expected that it will spread throughout the United States despite control measures. Using the airplane to spread poisons is a method that gives promise in the fight against the boll weevil.

But the pink boll worm which has gained a foothold in Texas, Louisiana and New Mexico is regarded as an even more serious pest. In all probability it would have won the fight but for the vigilance of a Baltimore inspector of the department. A passenger from Brazil landed with fifty packages of Brazilian cotton seed which he intended to take to the cotton section of Mississippi for planting. The Baltimore official, however, disovered these seed and found that living pink boll worms infested every package. If they had been let loose in Mississippi, officials believe that they would have quickly covered the portion of the cotton-belt.

MERE MAN AMONG THE TUAREGS

National Geographic Society News Bulletin

AMONGST the Tuaregs, found in the vilayet of Tripoli, it is man the brute who by all the laws of the country has to obey the women. Descent is traced through the mother; woman shows her proud face to all the world, while the man goes veiled. In the presence of a woman of noble birth, men cover their faces and heads altogether. The women give the children what little instruction they have and train them to respect and obey them.

Bullied and worried by his women-folk, the Tuareg has no liberty at all. All the goods, tents, camels and clothes are the women's property. The stick he carries and the great wooden box into which he puts what his wife suffers him to have are all the man possesses and all he retains if for some reason his wife chooses to divorce him.

In Ghat, when a man goes out after sunset he is usually followed by a negro servant, sent by his wife to dog his steps, and woe to him if he forgets himself or comes home too late! He will find the door shut and must count himself lucky if he is not put onto the street altogether.

The young man who, in spite of all this, wants to marry must pay a heavy sum for the bride, to obtain which he is obliged to look for other means than his usual work of rearing camels or carrying goods for the Arab trader. Thus he is forced into taking part in one of the annual rhazzias.

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One fellowship, yielding an income of $1,500. Preference is given to candidates who have already obtained their Doctorate, and have demonstrated by their work fitness to carry on successfully original research of a high order. The holder must reside in New Haven during the college year, October to June. Applications should be made to the Dean of the Graduate School, New Haven, Conn., before May 1, 1923; they should be accompanied by reprints of scientific publications and letters of recommendation, and a statement of the particular problem which the candidate expects to investigate.

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Formulae and Processes for Chemicals used in the Pharmaceutical Trade. Address: G, c|o Science, Garrison, N. Y.

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A man qualified to take charge of laboratory classes in Zoology is desired at Western Reserve University, for the second semester, beginning February 5, 1923; salary for the half year $1,000.00. Address **The Dean, Adelbert College, Cleveland, Ohio,** stating academic history and giving credentials.

The Sarah Berliner Research and Lecture Fellowship

This Fellowship of the value of from $1,000 to $1,200 is awarded annually for research in physics, chemistry and biology. The Fellowship is open to American women holding the degree of Doctor of Philosophy or Doctor of Science who give promise of distinction in the field to which they are devoting themselves.

The Committee in charge of the Sarah Berliner Fund desires to give explicit recognition to those candidates who can carry on research and at the same time have the privilege of giving one or more courses of lectures in some university or scientific institution.

Applications and recommendations for this Fellowship must be received not later than FEBRUARY 1, 1923, by the Chairman of the Committee on Award.

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EXPEDITION STUDYING SOUTH SEA BIRDS

Science Service

ABOUT 3,300 species of birds, including some heretofore believed extinct and some hitherto unknown to science have been secured by the Whitney South Sea Expedition of the American Museum of Natural History, according to Dr. Robert Cushman Murphy. Dr. Murphy is associated with Drs. Leonard C. Sanford and Frank M. Chapman in the administration of this expedition, which, through a contribution of $100,000 by Harry Payne Whitney, is the most elaborate expedition ever equipped primarily for bird study.

Much light has been thrown on the geographical distribution of many sea birds, as well as many insular land flyers. The collections show that birds of the tropical tradewind belt in the South Pacific are for the most part of a different race from those inhabiting the latitudes of calm farther south.

It has also been discovered that in some cases every inlet within a single group of islands has a well-marked geographic race. The range of some of these is no more than a few acres.

Although the expedition is primarily out to study birds, it is losing no opportunity to obtain material valuable to other branches of science. In some of the Polynesian islands the native people and animals are dying out or changing with changing conditions. Information in regard to these is being collected in cooperation with other scientific organizations.

In order to avoid duplication of work, it has been decided to leave the bird investigations in the Hawaiian Islands and certain neighboring groups, such as Miday, Johnston, Palmyra and Washington Islands, to the Bishop Museum of Honolulu.

The expedition is equipped with the most complete compilation of data known covering the notes on extinct, doubtful and mythical species of animals described by the early sailors of the South Pacific.

The collecting work of this expedition has hardly begun, but already many birds and bird-stomachs preserved in alcohol have been received. The contents of all of these stomachs will be analyzed and reported on by the United States Department of Agriculture.

Photographs are being taken not only of the birds and wild animals of the places visited, but interesting features of the life and appearance of the people and the islands are being captured at points where civilization has touched but little.

ITEMS

Science Service

ELKS will have to quit wearing elks' teeth or elks will be no more. This was the gist of an illustrated address by Representative Albert H. Johnson, of Washington, before the Ninth National Game Conference in Washington on December 12. He made a strong plea that in order to save from extinction the animal for which their lodge is named, the B. P. O. E. pass resolutions condemning the wearing of elks' teeth by their members. He told very vividly of the damage done by poachers who kill bull elk in the spring of the year simply to extract their teeth which have a commercial value, in that members of the Elks' Lodge buy them for watch charms, cuffs buttons and other decorative uses. As long as these teeth command a fancy price, men will be found who will take any risk to procure them, he said, and this means the ultimate extermination of the elk.

OVER a half million self-supporting farm homes can be created from the 30,000,000 acres of suitable land in this country which have already been examined, F. H. Newell, consulting engineer of the U. S. Reclamation Service, told the American Association for the Advancement of Science. Twenty million of these fertile acres have too much water and the other ten million have too little water. All engineering obstacles to their reclamation have already been overcome, he said, and the Reclamation Act should be extended to permit the taking up of more lands in a systematic, orderly manner.

THE undersurface of whales is sometimes infested with barnacles as are the bottoms of ships; but not with the same kind of barnacle.

SIAMESE rice growers of the interior fear to convert their rice into money because bandits prefer cash.

A RADIO wedding was recently performed at Pittsburgh and 500,000 persons are estimated to have "attended" the ceremony by ear.

DIAMONDS represent 94.3 per cent. of the $80,696,000 worth or rough gems which the world produces annually in normal years.

TESTS to determine a practical standard of illumination to make auto license tags readable at night at a reasonable distance are being conducted by the U. S. Bureau of Standards.

AN international committee appointed by the League of Nations is working to standardize serums for the treatment of pnemonia, meningitis, diphtheria and other diseases.

SCIENCE NEWS

SCIENCE IN 1922

Science Service

INTERESTING developments in science during the past year have occurred in various fields of organized knowledge.

ASTRONOMY, PHYSICS AND CHEMISTRY

Researches determined that blue and yellow light pass through empty space at the same speed.

The toal eclipse of the sun on September 21, visible in Australia and the South Pacific, was the occasion of six astronomical expeditions to test the Einstein theory. A partial eclipse of the sun was visible on March 28 in Florida.

Ten years of solar radiation observations were announced and the average value of the sun's heat on the earth is 1.94 calories per square centimeter per minute, or enough heat to melt a layer of ice 424 feet in one year.

Mars made a close approach to the earth in June.

Invisible sun spots were discovered at Mount Wilson Observatory by means of their magnetic effects.

Professor Sir Ernest Rutherford, of the University of Cambridge, announced that he is able to disintegrate the chemical elements, boron, fluorine, sodium, aluminum and phosphorus as well as nitrogen, and to obtain hydrogen from them by bombarding them with the powerful alpha particles of radium.

It was determined that E is the easiest letter to hear and that all ears hear differently.

A new device for sounding ocean depths by sound waves without the use of the sounding lines was perfected by the Navy.

A liquid, called furfural, was produced from waste corn cobs at low cost and can be used in making synthetic resins and as a motor fuel, saving the more expensive alcohols and gasoline now used.

A mixture of cyanogen chloride, a tear gas, and the common disinfecting gas, hydrocyanic acid, was developed as a better fumigating agent that is deadly and yet gives warning of its presence.

MEDICINE

A common chemical, carbon tetrachloride, was found to be an efficient substance for use in removing hookworms, in man, and it may replace the drugs formerly used, chenopodium and thymol.

Post-mortems of human beings who lived 4,000 years ago were made by means of an examination of Egyptian mummies who were found to have many of the diseases of to-day.

Dr. Hubert Work, then president of the American Medical Association, was made postmaster general. He became the second scientific cabinet officer, as Herbert Hoover, secretary of commerce, is a mining engineer.

A tendency toward cancer was found to be inheritable.

Minute amœba, single-celled animals, in the bone marrow were found to cause joint rheumatism or arthritis deformans.

Direct sunlight, unimpeded by glass or clothing, was found to be an effective cure for rickets.

The use of glands and their aid in rejuvenation was the subject of experiment and discussion.

Mother's milk was found to act as an antitoxin and vaccine that protects the new-born baby against disease germs.

An extract of the pancreas was isolated at the University of Toronto and this substance, called insulin, when administered to a sufferer from diabetes allows him to eat normal food, thus promising to control this disease, which is usually fatal.

Encephalitis or inflammation of the brain was transmitted experimentally from man to rabbits by inoculating them with the clear contents of ordinary cold sores.

An antiserum for combatting the highly fatal Rocky Mountain spotted fever was produced at the Rockefeller Institute for Medical Research.

Spraying the throat with pneumonia vaccine produced considerable immunity against virulent pneumonia in monkeys during U. S. Public Health Service experiments.

German chemists announced that they had perfected a drug, called Bayer 205, that cures the African sleeping sickness.

The hundredth anniversray of Pasteur's birth was celebrated on December 27.

AGRICULTURE AND BIOLOGY

The white-pine blister rust, a fungus or parasitic plant disease, invaded the great pine forests of the northwest, threatening many feet of timber.

A very fine colloidal material, called "ultra-clay," was found to compose an important part of the soil.

An insect imported from France was found to attack the destructive native corn borer.

A new method of treating phosphate rock in the electric furnace gave promise of better fertilizer.

The rose was discovered to be one of the worst enemies of the potato because it harbors the eggs of aphids that carry disease.

By using alum it was found possible to neutralize the alkalinity of soil that becomes impervious after several years of irrigation due to the formation of insoluble salts.

The true wild species of potato, from which our cultivated potatoes come, was found in the mountains of northern Ecuador.

The mystery of why a heifer born twin with a bull is usually sterile was found to be due to the action of gland secretions before birth.

It was found that artificial illumination can entirely replace sunlight in growing any common crop plants and weeds and that as the seed is perfectly normal it will be possible to grow three generations in a year instead of one by this method.

The fishy taste in butter was traced to a chemical substance known as "trimethyl amine."

A cheaper method of combating the cotton boll weevil, consisting of treating the unblown buds of the plant, was developed in Florida.

An insidious marine foe, the shipworm or teredo, threatens the destruction of New York's wharfs and docks and study of the situation is begun.

In the case of a tiny water animal, the rotifer, it was found possible to make a female animal produce either all females or males by simply varying the food.

A platypus, an Australian animal that has the bill of a bird, the fur of an animal, lays eggs and yet suckles its young, was brought to America alive for the first time.

Differences in bacteria due to age were discovered and it was found that these minute organisms suffer from infant mortality.

X-rays by action on the chromosomes in the cells of flies will produce irregular progeny and control sex.

The essential oils that cause the fragrance of flowers were found to serve as a protection against extreme heat and chill.

A method of protecting wood from land and water insect damage by treating with paraffin and poisonous salts was discovered.

ENGINEERING AND RELATED SCIENCES

Methods of using the greatest potential power sources, the Colorado River, were considered and treaties between the states concerned were completed.

In three localities model experimental roads were built and worn out in order to obtain data for better design of highways.

The coal strike beginning April 1 shut off power equal to four hundred times the energy actually developed at Niagara Falls.

French experiments with motors of the Diesel type indicated that motor vehicles will be able to use heavy oils instead of gasoline.

The American Liberty aero engine was modified experimentally to use heavy oil instead of gasoline.

Writing in the sky by means of smoke sent out from airplanes in flight was perfected.

By using paper models, design of concrete buildings was improved.

In gliding and soaring contests in Germany, France and England, two motorless flights over three hours in length were attained.

The army airship C-2 was destroyed while on a trans-continental trip.

Prospecting and mapping by airplane came into more general use and was made more accurate.

Researches on the level of water in the Great Lakes lead to the conclusion that man would have to regulate their level artificially in order to secure their most economical use in power and transportation.

ANTHROPOLOGY AND PSYCHOLOGY

Finding of the Rhodesia skull of pre-historic man during the previous year revived interest and speculation in ancient man.

Evidence was presented that man existed before the Great Ice Age at least 520,000 years ago.

The finding of a fossil tooth thought to be that of an intermediate between ape and man, in the home state of William Jennings Bryan, principal opponent of the facts of evolution, started a search for further evidence of the animal.

Attention was turned toward the problem of giving the gifted or bright student better opportunities in our schools and colleges.

Leading psychologists formed a corporation for the advancement and practical application of psychology, the profits of which must be used for research.

RADIO

Radio broadcasting of speeches, music, entertainment and news became national in scope.

Life-saving boats of the Coast Guard were equipped with radio apparatus.

The national radio conference called by the Department of Commerce laid plans for the extension of this relatively new method of communication and recommended legislation.

"Wired wireless" or line radio was demonstrated by Major General George O. Squier to be

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Each class is limited to 75 students, men and women being admitted on the same terms. **Except in unusual circumstances, applications for admission will not be considered after July 1st.**

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Reorganized on a full-time basis

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ALL THE GENERAL FACILITIES OF THE UNIVERSITY ARE AVAILABLE TO MEDICAL STUDENTS

As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

useful as an additional method of broadcasting over telephone or electric-light wires.

American radio amateurs established regular communication with Hawaii and Porto Rico and held successful trans-Atlantic tests for the third time.

Major E. H. Armstrong, inventor of the regenerative radio circuit, created a new super-regenerative circuit that produces signals 50,000 and more times greater than those ordinarily produced by the same apparatus wired in the ordinary way.

Alexander Graham Bell, inventor of the telephone, died.

EXPLORATIONS

Dr. D. B. MacMillan returned from his expedition to Baffin Land bringing important geographical, magnetic and other scientific data.

Captain Roald Amundsen and his expedition left on the *Maud* for a drift across the Arctic Ocean.

The discovery of an archaic pyramid in Mexico indicated that human history in America began as early as the primitive civilizations around the Mediterranean.

Five Mayan cities abandoned hundreds of years ago were discovered in the forests of Yucatan and Guatemala.

A rich collection of utensils and adornments was discovered in the tomb of King Tutankhamin, in the Valley of Kings, near Luxor, Egypt.

ASTRONOMICAL EVENTS IN 1923

By Isabel M. Lewis, U. S. Naval Observatory.

Science Service

Two astronomical events of exceptional interest that will take place in 1923 are the occultation of the planet Venus by the moon on January 13 and a total eclipse of the sun visible in California and Mexico on September 10.

There will be in all four eclipses in 1923, two of the sun and two of the moon. A small partial eclipse of the moon will take place on March 2 which will be visible in Europe, Africa, the Atlantic Ocean, South America and North America, except in the extreme northwestern part. At greatest eclipse thirty-eight per cent. of the moon's diameter will be covered by the earth's shadow.

On March 17 there will be an annular eclipse of the sun visible in the extreme southern part of South America, the South Atlantic Ocean and South Africa. The path of the annulus will cross Patagonia, the Falkland Islands, South Africa and Madagascar and the maximum duration of the annular phase of the eclipse on the central line will be nearly eight minutes. The partial phase will be visible over all of the southern part of South America, the South Atlantic Ocean and Africa.

Another small partial eclipse of the moon will occur on August 26, visible in the Pacific Ocean, Australia, western South America and in all of North America except the extreme northeastern part. At greatest eclipse only seventeen per cent. of the moon's diameter will be covered.

The total eclipse of the sun that will occur on September 10 will be visible in its partial phase over all of North America, Central America and the northwestern part of South America. The path of total eclipse starts a little to the south of Kamchatka at sunrise, crosses the Pacific to San Clemente Island off the coast of California, touches California in the vicinity of San Diego and the Mexican border, passes over Mexico and Yucatan and leaves the earth at sunset a little to the south of the West Indies. The circumstances should be particularly favorable for the observation of this eclipse both in Mexico, where the path will pass over many excellent points at high altitudes, and in southern California, where astronomers on the Pacific Coast are now planning to observe it.

The planet Venus, which will present an interesting and beautiful spectacle on the morning of January 13, when it will be occulted by the moon in the crescent phase will be a resplendent object in the eastern sky before sunrise for some time to come. It will reach its greatest distance west of the sun on February 4, when it will rise about three hours before sunrise. After that date its angular distance from the sun will decrease but it will continue to be visible in the east before sunrise until shortly before it comes into conjunction with the sun on September 10. From that time on to the end of the year it will be in the western sky after sunset.

Jupiter is now near the meridian at sunrise and Saturn is some distance to the west of Jupiter in Virgo. Saturn will remain in the constellation Virgo throughout the year and Jupiter will be in Libra until December, when it will pass into Scorpio. Both planets will be seen at their best in the spring when they come into opposition with the sun and will then be visible all night. Saturn will be in opposition on April 7 and Jupiter on May 5. They will be visible after sunset throughout the summer and into the fall until within a few weeks of their conjunction with the sun, which occurs for Saturn on October 17 and for Jupiter on November 22. Several weeks after

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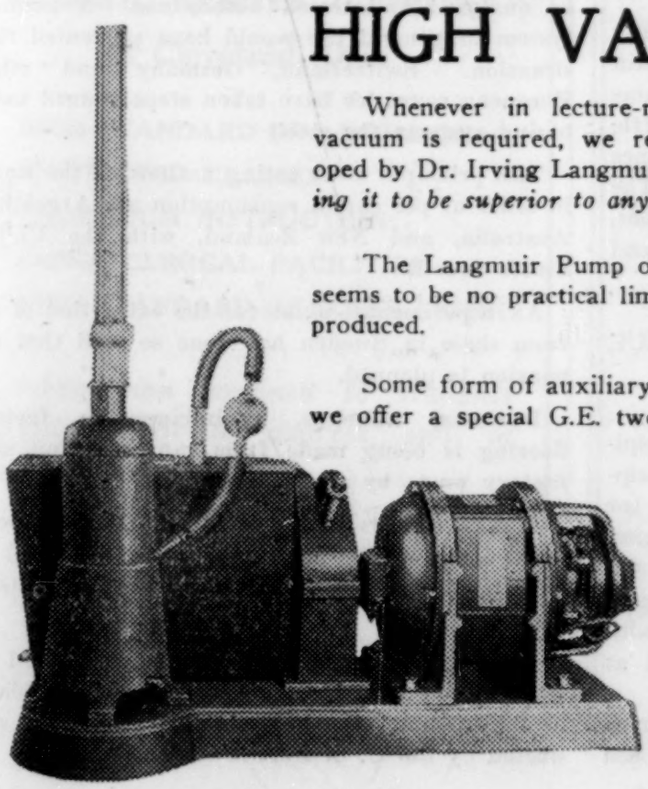

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conjunction with the sun they will be seen in the east just before sunrise.

TOYS OF AMERICAN INDIANS

Science Service

TOYS of the American Indian tribes never before exhibited have just been placed on exhibition in the division of ethnology of the U. S. National Museum. These playthings of the papooses from Alaska to Mexico reveal that the redmen were efficient toy-makers and that their children found delight in the same imitation of their elders taken into consideration by the manufacturers of our modern Christmas amusement devices.

While little Indian girls, the exhibit shows, could not hug the talking, walking and sleeping dolls of our mechanical age, they did have plenty of dolls, with miniature teepees instead of doll houses, and little cradles to carry on their backs like the ones their mother carried them in when they were babies. Among these dolls is one of the tiny Eskimo which is a real stuffed wild duck for baby to play with.

Animal dolls were evidently very popular among the Indians. An ingenious beaver with a tail of leather marked in imitation of the big flat tail of the real beaver was made by an Appapaho papa for his papoose. Cute little woolly buffaloes made out of different colored beads are shown. Miniature elk and targets cut in the shape of buffaloes for little Indian boys to shoot at are also shown.

There are horse dolls and one doll is a tiny horse believed to have been made from the skin of an unborn colt on account of the lack of seams in the delicate hairy coat covering the little wooden image. These presents were sometimes exchanged when the families went visiting. The exhibit included material from Appapahos, Shoshones, Hopi, Utes, Apaches, Cheyennes and other Indians.

LEAGUE REVEALS DETAILS OF PLAGUE IN UKRAINE

Science Service

MORE than 1,300 bodies waiting burial, hospitals swamped with cholera victims, hundreds helpless in the homes, vermin swarming unchecked for lack of fuel and water, with inoculation rendered ineffective for want of food, are among the details of the epidemic of cholera now subsiding in the Ukraine as revealed by a report of the Health Section of the League of Nations published at Geneva.

At Odessa prophylactic inoculation was resorted to only after hundreds of cholera cases had been reported. The ten sanitary officers available found themselves unable to visit and isolate all the cases. Hospital accommodations were never adequate. There was but one auto truck available to remove the dead. Labor was hard to get to move the plague stricken dead. Bodies were pitched into a common pit and chloride of lime thrown on top of them. Lack of water and fuel made delousing and bathing practically impossible. Similar conditions were found at Kherson, once the chief town of the government, the streets of which are now all but deserted. Experience in this epidemic has also demonstrated that protection against cholera by vaccination varies according to the state of nutrition of the vaccinated population.

ITEMS

Science Service

"SEND me steel No. 50," will be the way in which manufacturers will order the particular kind of metal that they need if plans inaugurated by the American Engineering Standards Committee cooperating with other engineering organizations and steel producers and users are carried out. Much confusion due to the necessity of long and detailed specifications is experienced now and the number and standardization of common specifications will save much waste and time, it is declared. The Navy Department has a million pounds of unidentified steel which must all be analyzed and tested before use. A number system in general use would have prevented this situation. Switzerland, Germany and other European countries have taken steps toward numbering systems for steel.

THE principal meat eating nations of the world in order of per capita consumption are Argentine, Australia, and New Zealand, with the United States fourth.

AN experimental plant for the extraction of oil from shale in Sweden has done so well that expansion is planned.

DURABLE, noiseless, noninflammable factory flooring is being made from tanneries and shoe factory waste by a shoe company.

WATER carriers in the streets of Fez, Morocco, furnish the public with free water collected in pots made by lepers who live in caves outside the city's walls.

TESTS to determine a practical standard of illumination to make auto license tags readable at night at a reasonable distance are being conducted by the U. S. Bureau of Standards.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

THE SEPARATION OF ISOTOPES

Science Service

PROFESSOR JAMES KENDALL, of Columbia University, reports a new and ingenious method for separating atoms of the same elements having different weights. It used to be supposed that all the atoms of the same element had exactly the same atomic weight. But it has recently been discovered that this is not always true. Many of the elements are known to exist in more than one form; "isotopes" is the name given them.

Since the isotopes of an element have the same chemical properties it is not possible to separate them by chemical means, so they have hitherto escaped detection. What was known as the atomic weight was an average of the natural mixture of two or more atoms of different weights. Chlorine, for instance, was a puzzle, for its atomic weight figured out very close to 35.5, whereas it should have been a whole number, a multiple of the unit, hydrogen. But now we know that the chlorine atoms are of two sorts, one weighing 35 and the other 37, the two being mixed in minerals to average 35.5. But in order to separate them some physical means must be adopted.

One of Professor Kendall's methods is to fill a long tube with a jelly made of agar-agar containing salts in solution. In the middle is a short section containing chloride. When an electrical current is passed through the tube the chlorine moves slowly toward the anode. But since the chlorine atoms have different weights they may be expected to move with different speeds, and after they have traveled a hundred feet or so through the tubes the heavier should lag behind the lighter, so the front part of the chlorine section of the jelly will contain entirely one isotope and the back part entirely the other. This method may also be used for the separation of the rare earths which are so near alike in atomic weights and chemical behavior that it is a long laborious process to sort them out.

The practicability of the method has already been proved by running off preliminary heats with mixtures of two common substances, one of which was known to make slightly better time under the action of the electric current than the other. After the race had progressed only a few feet, chemical tests showed that a perfect separation had been effected. Unless, therefore, the heavy-weight chlorine atoms are capable of running a dead-heat with the light-weight chlorine atoms in spite of their handicap of avoirdupois (a possibility which is scarcely to be anticipated), a complete separation of isotopes will, for the first time in history, be accomplished.

THE ORIGIN OF COMETS

Science Service

ALL known comets are members of the solar system and are not vagrant wanderers from interstellar space, according to mathematical investigations made by Professor Stroemgren, the royal astronomer of Denmark. After twenty-two years of research on this problem Stroemgren refutes the older belief that some comets drift in from the vicinity of other stars.

Until the time of Tycho Brahe, three hundred and fifty years ago, comets were believed to be phenomena of the earth's atmosphere. Tycho Brahe succeeded in proving that they are celestial bodies, and mathematical astronomers later were able to compute the orbits around the sun. Comets were shown by Newton, Halley and their successors to be governed by the universal law of gravitation.

The movements of comets, like those of the planets, are controlled by the sun. The gravitating power of the great amount of matter concentrated in the sun dominates this region of space. Jupiter, Mars, Earth and the other planets, however, seriously disturb the cometary motions. Astronomical calculations show that the orbits or paths of comets around the sun are elliptical, parabolic or hyperbolic. Elliptical paths are closed; comets that travel in such orbits return from time to time to the neighborhood of the sun, where they become more luminous and may be observed. The parabolic and hyperbolic orbits are not closed, and comets traveling along those paths do not return to the solar system.

The new theory maintains, however, that all comets originally traveled in elliptical or closed orbits, periodically coming closer to the sun from the outer regions of the planetary system. It maintains that the material composing comets is a part of the original nebula out of which the sun and his family are thought to have formed. According to this theory, the disturbing influences of the planets have changed the orbits of some comets from the closed paths to the open form. That is, the perturbations by the planets have resulted in throwing some of the original material of the solar system off of its beaten track and out into the emptiness of interstellar space, never to return.

The planets have no difficulty in disturbing greatly the motion of a comet, as the amount of

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matter in a comet is extremely small. Although there is but little material in a comet's head, we frequently find it expanded, because of its great rarity, to enormous dimensions. Recent photographs made at the Harvard College Observatory show that Baade's comet has a volume nearly ten times that of the earth.

This faint comet is now outside the orbit of Mars, slowly receding from the sun.

THE CAVE MEN OF EUROPE

Science Service

WITHIN fifty years, according to Dr. Aleš Hrdlička, of the Smithsonian Institution, great discoveries bearing on man's development from his ape-like ancestors will be made. Just back from an examination of the known sites of ancient man in Europe, Dr. Hrdlička stated that the deposits of early skeletal remains are vast and emphasized the importance of organized, systematic research in bringing their precious contents to light.

"The surface has hardly been scratched," he said, "by discoveries of early man so far made in west central and south Europe, while nothing has been done to explore the tropics for evidence of early man and his predecessors which are probably present there. Expensive expeditions are constantly being fitted out to dig up pottery and other recent relics of man, but the development of man himself from more primitive forms, the very essence of man's history, is largely neglected, or carried on in a haphazard manner or by amateurs.

"At Ehringsdorf near Weimar and Obecassel, Germany, at La Quina, France, at Predmost, Moravia, and elsewhere, primitive cave-dwellers of the Neanderthal or later type lived 150,000 or more years ago and the accumulation of various cultural remains left by them is very striking.

"At La Quina the talus containing remains of ancient man extends along the low cliff bounding the valley for nearly two miles, with a strong probability that there are caves in the cliff in which man of a hundred thousand years ago found shelter; and of these accumulations not one fiftieth has yet been examined. They abound in worked stones and bones of long extinct animals hunted by the ancient human beings who here and there have left the remains of their own skeletons in these refuse heaps and clays."

The skulls of these early inhabitants of Europe, though probably ancestral to those of man of today, are distinctly different from those of any modern races. They are heavy and low browed, heavy-jawed, and the lower jaw has as yet no chin prominence, the chin in fact is often markedly receding as in the great apes. While we speak of these people as cave-men, several of the specimens recovered are probably women, while recently a complete skull of a cave-child was found, the first so far revealed.

In the ten to hundred thousands of years represented by these remains, there are noticeable differences in the earlier and later skulls. There is a gradual progression toward the modern type, but all the stages are not yet known by well preserved specimens.

"These people represent various links in the chain of man's evolution from early apes. Man did not develop from any of the present day apes, but represents a separate line of descent from the pre-human form which in turn arose from long extinct simian forms."

Systematic explorations of caves in the Malay peninsula, India and Africa, Dr. Hrdlička thinks, is an urgently growing need and would in all probability yield most important evidence on the problem of man's rise in the world. There is a great opportunity for America to lead in these explorations, he believes. But he says that in this country there is no prospect of finding any of these early men or ape-men, as the earliest Americans came to this continent from Asia already as true men.

EARTHQUAKES

By Dr. Bailey Willis, professor of geology, Stanford University.

Science Service

EARTHQUAKES are a natural occurrence in certain regions of the world where the mountains are alive. There are districts, like the Atlantic Coast, where they are dead, but around the Pacific and in a great belt which reaches across Asia and the Mediterranean the mountains are growing. In their growth large masses comprising many thousand cubic miles of rock are pressed against each other but are held by friction until the strain becomes too great. They then slip and an earthquake occurs.

This is the modern theory of earthquakes. It was developed through the studies of the great earthquake of 1906 which caused the fire that destroyed San Francisco, and it has been demonstrated since by observation of many minor earthquakes and by a study of the lines along which they occur.

We often speak of an earthquake plane as a fracture, but it is not really a break. It is the surface between two great masses which never have been united, but which for ages have been slipping past each other; and where this plane comes out to the surface of the earth we have a

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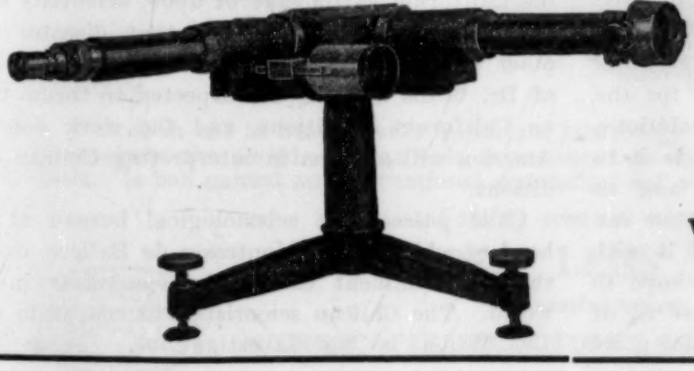

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line which is sometimes called an earthquake rift. The greatest of these rifts, so far as it is known, in the United States extends through the coast ranges of California for a distance of six hundred miles. It passes just west of San Francisco, to the east of Los Angeles, and disappears in the Gulf of California. Along the San Andreas rift, as it is called, earthquakes have occurred at different times in different sections; the most recent was the quake of 1906, which covered a stretch of one hundred and fifty miles with San Francisco near the center. South of that stretch for some three hundred miles there has been no movement since 1857 when there was a severe shock, the mark of which may be traced across the desert plains like an irrigation ditch. Still further south there have been several recent shocks, but none of great violence, although there is evidence of considerable activity in the section east and south of Los Angeles.

In view of the fact that we can thus locate certain lines along which earthquakes have occurred, we are able to speak of live earthquake rifts as we speak of live volcanoes. We know by the form of the volcano or by the occurrence of eruptions within historical time that it is potentially or actually active, and much the same may be said of earthquake rifts. They are lines of special danger on which no dam or schoolhouse or skyscraper should be located. They should also be avoided, as far as possible, by railroad lines, bridges, aqueducts and other public works, and yet it happens that they often run through valleys where such work is suggested by the conditions of the ground. As long as we remain ignorant of their position, we run the risk of inviting destruction, but it is not difficult by proper studies to locate the lines of danger on a map and to make the information public for the benefit of engineers and others.

Thus it happens that a map of California, showing the lines of active earthquake rifts and also of faults that are believed to be inactive, is about to be published by the Seismological Society of America as a result of work carried out in cooperation with the Advisory Committee in Seismology of the Carnegie Institution of Washington. It is, however, but one item in the program of that committee, which embraces plans for the investigations of earthquakes in many relations.

It may perhaps be asked of what use is it to study a phenomenon which is as sure and as inevitable as an eclipse of the sun. Since we can not stop it and probably can not predict it with certainty, what practical benefit can we hope to derive from an investigation of it? There is, of course, the answer that we wish to know; we wish to understand our earth and all its manifestations; but apart from that, as has already been pointed out, the lines along which earthquakes are likely to occur and are most dangerous may be determined and it seems not impossible that if we can perfect our knowledge we may be able to devise methods of forestalling their disastrous effects by the selection of safer locations or by appropriate methods of construction. It is clearly recognized, for instance, that the destruction of San Francisco was in large measure due to the fact that its principal aqueduct followed the earthquake rift for many miles, whereas now it has been located along a mountain range which, if it moves, will move as a block and will not dislocate the pipe line.

STUDY OF CHILEAN EARTHQUAKE

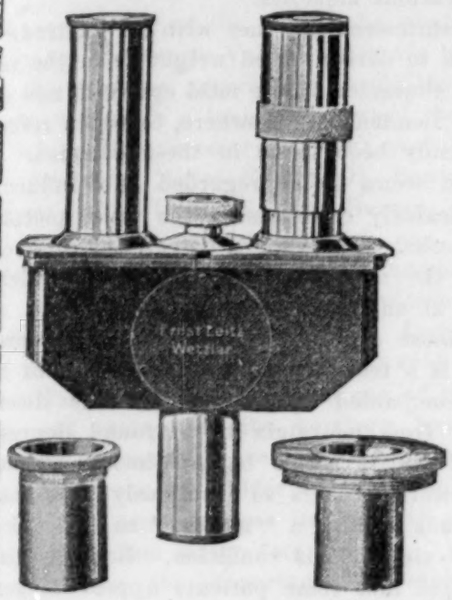
Science Service

WITH the avowed purpose of capturing and embalming the recent Chilean earthquake, Dr. Bailey Willis, professor of geology at Stanford University, will sail for South America on January 11, as the representative of the Carnegie Institution of Washington.

For four or more months, Dr. Willis plans to search for and study the great slipping of the earth that has left its mark on the landscape and rocks of Chile. Traveling in the old fashioned way on horseback and with pack mules in a country with few roads and inhabitants, Dr. Willis will work under conditions similar to those that existed in the American Far West before the Ford became omnipresent. It will be necessary to survey along a stretch of coast extending about one thousand miles north of Valparaiso, he believes, although the details of cooperation with Chilean scientists have not yet been fully worked out. For four years, Dr. Willis has been consulting geologist to the Argentine government and he is acquainted with South American conditions.

The similarity between the earthquake conditions in Chile and California is one of the reasons for American interest in the earth movements along the Pacific coast of South America. Since the California earthquake of 1906, scientists have been studying the causes of that disaster and other quakes in that region. The investigations of Dr. Willis in Chile are expected to throw light on California conditions, and the work done in America will aid him in interpreting Chilean conditions.

Chile possesses a seismological bureau at the head of which is Dr. Montessus de Ballore, one of the most eminent earthquake specialists in the world. The Chilean scientists will cooperate with Dr. Willis in his investigations. Señor Don



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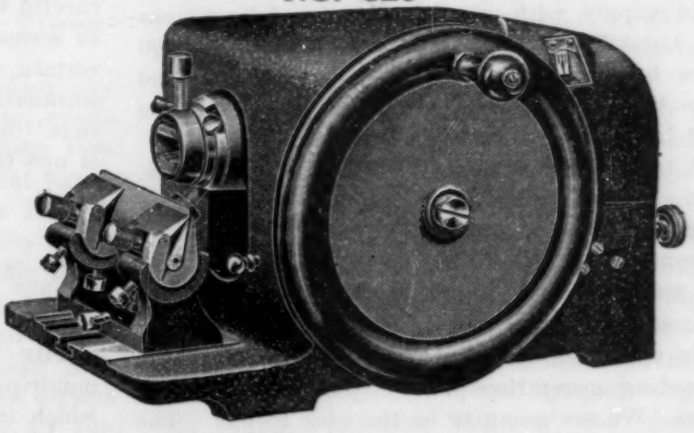

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Baltram Mathieu, the ambassador from Chile, is greatly interested in this cooperation between the geologists of America and Chile.

OUR FORESTS

The New York State College of Forestry

THE wood supply of the future must be obtained chiefly from land that has been denuded of trees and which is now producing little or no merchantable timber. This is inevitable. Our wood supply can not be obtained from the forests that are left for more than one generation. We have already cut or burned over about five sixths of our original timbered area. Timber in the United States is being cut and destroyed nearly six times faster than it is growing. The demand is increasing. As the demand increases the consumption of the remaining timber will increase proportionately. We have enough left to keep us going at the present rate of cutting from twenty-five to thirty years. That is all. After that, timber for commercial purposes will be of inferior quality and of great scarcity. A timber famine will confront us. Our industries and the people at large will feel this stringency of wood supply severely. Civilization can not progress without forests.

It requires about fifty years to grow a merchantable white pine tree. It requires from thirty to forty years to grow a spruce tree for pulpwood. It requires from sixty to seventy years to grow a spruce for merchantable lumber size. Fires each year burn over many times more land than all the tree nurseries in the United States could supply with plants. In the Adirondacks and Catskills since 1903 approximately 1,200,000 acres have been burned over, but only 70,000 acres have been reforested on public and private land in the entire state during that period.

It takes time, labor and money to plant trees. It would mean many years of reforesting before an adequate area could be planted. The federal government, the states and private owners should put into effect a comprehensive planting program commensurate with our rapidly increasing needs. It is up to the people to see that this is done. Preceding generations have "passed the buck" to us. We are going to be the ones to pay. The longer we delay reforesting, the higher will be the price. How much we pay depends on how long we wait.

THE NEW "INFLUENZA"

London Times

A SHORT time ago a distinguished physician expressed the view that "the face of disease" is changing. He said that practitioners in many parts of the country told him that they could no longer easily recognize the text-book descriptions of the various maladies.

This statement has met with no contradiction. It seems to derive added weight from the rather unusual character of the mild epidemic now prevalent in London and elsewhere, to which reference has already been made in these columns. This epidemic seems to be regarded as "influenza," yet it scarcely conforms to the usual picture of that disease. Nor is there, as yet, any appreciable rise in the mortality from influenza, which, in London at any rate, remains very low.

The most conspicuous feature of the present trouble is a tendency to sickness or loss of appetite accompanied by various nervous disorders ranging from neuralgia to profound depression. Loss of spirits seems to be almost invariable; this, however, occurs so insidiously that the patient tends to take a "mental" as opposed to a physical view of his condition. Recovery is not very rapid and some patients appear to remain unwell for several weeks.

There is no doubt of the epidemic character of the complaint, for large numbers of people are affected. On the other hand, it is difficult to use the title "influenza," because there is lacking the usual cold, or coryza, of that complaint and because the ordinary complications of influenza have not appeared. Nevertheless, we may note that the temperature this winter has not been so low as that experienced in December of last year, when influenza developed on a big scale.

There is certainly need at the moment for a careful study of the new features of disease. If, as seems probable, our text-books are obsolete in certain directions, it is time that the necessary emendations were made. Names such as "influenza" have been overworked; their too ready use is apt to obscure ignorance and so retard study.

ITEMS

Science Service

FREE medical advice by radio is furnished to ships at sea by the U. S. Public Health Service.

THE city of Calais, France, has started a municipal dairy and dairy farm, the milk from which is to be tested by health officers and the cows fed scientifically to keep the quality up to that prescribed for young babies.

DUTCH threshing machines are designed to preserve, as far as possible, the length of the straw, which is used in making strawboard.

AN international committee appointed by the League of Nations is working to standardize serums for the treatment of pneumonia, meningitis, diphtheria and other diseases.

SCIENCE NEWS

RADIO AND WEATHER PREDICTIONS

Science Service

ESTABLISHMENT of the three radio weather stations in the Mackenzie Valley, which are to be set up by the Canadian government during the coming summer, will mark a long step toward the world-wide information necessary to make probable long range forecasts, Major Edward H. Bowie, meteorologist of the U. S. Weather Bureau, declared here to-day. In cooperation with our Alaskan stations and those of southern Canada, these radio outposts will forward observations taken over the most important region of Arctic night from which our outbursts of intense cold come.

The Mackenzie River Basin is one of the three great cold centers of the northern hemisphere. Siberia and Greenland are the other two. These large land areas are colder than the polar seas, because land tends to lose its heat by radiation more readily than water does.

Emphasizing the importance of observations from such regions for both hot and cold weather prediction, he said that soundings made in recent years by means of balloons and kites indicate that the fundamental cause of our storms is to be found in the general movements of our upper air. Rivers of cold wind from the north sweep toward the tropics and the currents warmed by the tropical sun flow north in a constant attempt to create an atmospheric equilibrium.

Owing to the rotation of the earth, winds are deflected to the east and the cold winds from the Mackenzie Valley sweep southeast over our country, while Europe, in the words of the old hymn, literally gets its weather from "Greenland's icy mountains."

Not until 1900, however, did Europe have any meteorological observatories beyond her coasts from which warnings could be sent. Since then stations have been set up by international agreement on the island of Jan Mayen, in Iceland, in Greenland, and arrangements are now being made to establish another station on Baffin Land.

To illustrate the interchange of air between north and south, Major Bowie explained that a mild winter in North America may mean that, owing to differences in the tropics of the eastern and western hemisphere, the cold upper air currents from the region of Arctic night have taken an Asiatic course toward the tropics rather than southeast through the United States.

Sometimes cold winds from Siberia sweep across Bering Strait and take a southeastern route through America, he stated in pointing out the importance of observations obtained from the Russians before the war.

Meteorologists, however, have been too accustomed to consider the northern half of the world as a separate climatic system little influenced by what is going on in the southern half. There is a seasonal leakage between the two hemispheres, and a knowledge of conditions in South America, Africa and other southern lands is necessary to the most effective weather forecasting.

Lack of information from all sections of the earth is the reason that predictions far in advance can not be made. With reports from observatories in all sections of the globe, it is probable that accurate long range forecasts could be made.

A STELLAR CAREER

Science Service

THE brilliant new star, Nova Aquilæ No. 3, which for a few days in 1918 was the brightest star in the sky, with the exception of Sirius, and which in actual light-giving power was one of the greatest objects ever recorded, has now, after an eventful career, settled down to its normal and original faintness, according to a report being published from the Harvard College Observatory. Nova Aquilæ No. 3 was the brightest new star seen for more than three centuries.

The chapters just written at Harvard in the history of this nova call to mind the exciting beginnings of its story, which were followed promptly by a gradual decline, both in activity and in scientific interest. From now on the nova, that was formerly the concern of a hundred observers, will receive only a moderate amount of routine attention. It has had its day.

On June 5, 1918, and for at least thirty years before that, Nova Aquilæ No. 3 was an ordinary faint star of the tenth or eleventh magnitude, visible only with the aid of telescopes. Four days later it rivaled Sirius in brightness, being, in astronomical language, of magnitude —1.2, and 40,000 times brighter than it was the week before. This sudden leap into visibility and consequent fame was accompanied by remarkable changes in the color and character of the light, showing that the matter composing the star was disrupted, enormously excited, and thrown out of equilibrium by the cataclysmic rise in temperature. Whether the catastrophe was brought about by a collision of the star with another star or with a nebula, or whether it represents an internal explosion, astronomers are not yet prepared to say.

The new star was discovered by scores of observers in all parts of the world. Probably the first to observe it was G. N. Bower, at Madras, India. He saw the nova on June 8 when the time at Greenwich was 4 P.M., corresponding to 11 o'clock in the morning at New York. His priority is due, no doubt, to the fact that the darkness of night comes earliest at points far to the east of the Greenwich meridian. Later in the same day, and long before Bower's observation became known, many Europeans and Americans discovered for themselves the brilliant new star in the eastern sky.

A nova as bright as the first magnitude is of such rare occurrence that astronomers all over the world began investigations immediately, with all the means at their disposal. In fact, no new star has been so well observed as Nova Aquilæ No. 3. During the first months, when it was visible to the unaided eye, it was followed by amateur and professional astronomers everywhere; afterwards only by those who had suitable instruments. The result was that in less than a year more than six thousand visual observations of the light variations had been accumulated at Harvard from two hundred and fifty different observers in countries scattered over the entire globe. More than a thousand photographs were made in Cambridge, Canada, Peru and China, and a discussion of this work is now in press.

Since the exciting part of its career, in 1918-1919, telescopes have kept a complete record of the star's activities. An account of its past variations in light, color and spectrum is recorded in the Harvard publications; and now it is announced that the star has returned to normal brightness. The peculiar spectrum of Nova Aquilæ, however, will probably continue for some time to show that here is a star with a past. Its career has been similar in almost all details to the careers of other novæ, the chief distinction in this case being the unusual brightness attained, not equaled since the nova observed by Kepler in 1604.

IMITATION WOOL FROM COTTON

Science Service

THE large French textile concern, Société Gillet et Fils, has developed a process for making an imitation wool from cotton. The process has also been patented in the United States.

Wool is an animal fiber, derived from the sheep, while cotton is a vegetable fiber, grown in the fields. These two fibers, so different in origin, also differ essentially in their structure and sensible properties, so that they can be rather easily told apart in the yarn. But when they are woven into fabrics and especially when a woolen cloth contains some cotton, it is a difficult matter to determine which is which. Thus, only those expert in textiles can tell definitely whether a fabric is all wool or not by the mere feel of the goods. The chemist can detect the presence of cotton in wool under the microscope. When the two fibers are examined individually, the burning test indicates wool by the characteristic odor of burning feathers.

The new process of making imitation wool from cotton effects a change in the fiber, so that cotton also burns with the odor of burning feathers. This peculiar odor is due to the presence of the element nitrogen in the form of protein matter in the wool. When the twisted cotton fiber, which has the property of absorbing and holding fast liquids even when subjected to vigorous washing, is treated with a solution of protein in the partially decomposed state, the cotton is converted into an "artificial wool."

The process is simple. A solution of glue or gelatine, egg albumen or casein is first partially broken down by acid and then the cotton fabric or yarn is impregnated with it. By varying the temperature, the time of immersion and the proportions and nature of acid or protein, the degree of conversion can be regulated within wide limits. After the cotton fiber has absorbed the protein, it is removed from the bath and washed with water. This has the effect of precipitating the protein on the fiber in an insoluble condition. As the solution has penetrated into the internal structure of the cotton, this results in the latter being completely filled with insoluble protein matter, which can not be removed under ordinary conditions.

The process is applicable to vegetable fibers other than cotton. Either the yarn or the finished cloth can be treated with equally good results. Mercerized cotton cloth can also be converted by this process, as the mercerization has no effect on the ability of the fiber to absorb the protein solution.

"Artificial wool" has characteristic properties of natural wool. It resembles the latter so closely that the burning test can no longer be used to tell whether the fiber is real wool or not. Increased strength, good wearing qualities, a certain amount of waterproofing are claimed for this new fiber.

SOUND SUPPRESSION

Science Service

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suppression which will probably prove applicable to telephones, phonographs and musical instruments so that these machines will give us only those notes we want to hear.

Dr. Stewart does not obtain his results by putting obstructions in the path of the unwanted sound waves, but by causing successive waves to interfere with each other's transmission. Illustrating how this was done, he took a brass cylindrical tube one half inch in diameter and six inches long, containing nothing but air and open at both ends, and caused it to transmit all tones of a piano, up to a certain note, and above this to transmit no audible sound. With another similar tube, the tones below this same or any other note were refused transmission, but all higher tones passed freely. The tubes, while entirely open and free from obstruction, have, at regular intervals, branching tubes and chambers. At each branching point waves are reflected backward through the tube.

"The design of the branches can be made in such a manner as to produce a backward reflection and an interference of almost any group of tones," Dr. Stewart explained. "This new basic method of sound wave manipulation may find application in many acoustic devices in use to-day. In fact, there is opened to the imagination the possibility of the elimination of undesirable noises and the enjoyment of sounds adjusted to an individual's esthetic taste." Dr. Stewart calls his device an "acoustic wave filter."

THE EXTERMINATION OF FUR-BEARING MAMMALS

Science Service

H. E. ANTHONY, associate curator of mammals of the American Museum, estimates that the present rate of destruction of mammals throughout the world is probably not less than fifty million a year, of which thirty million represents the demands of the fur trade. Extermination of large animals has been going on for a century, but the extermination of the small mammals has been extremely rapid in the last two decades. Muskrat, squirrel, mole, raccoon, opossum, formerly slightly valued for fur, have been relentlessly pursued to satisfy the demands of fashion.

Europe, North America, Asia and Africa have eliminated their wild animals through similar causes. Food supply, fur supply, industry, art, agriculture and deforestation, and, in a minor degree, sport, all have helped. The number of game animals still surviving in the mountains of Asia is relatively great.

When cave men first began the destruction of mammals for food and clothing some 400,000 years ago they were probably less destructive with their primitive weapons than most of the large predatory animals. These early men first used light from burning animal oil and fat and this demand has culminated in the elimination of the sperm whale and other marine carnivora. Twelve thousand whales have been taken in a single season from the American Antarctic.

Agriculture on land, the legitimate clearing of the land and protecting farms and gardens has been another cause of elimination. The ranging of cattle and sheep over great areas, destroying winter food for game, the killing of game by herd tenders, the bounty system against carnivora and indiscriminate poisoning campaigns have all been factors. Agriculture, the meat supply and the fencing of land is eliminating the game of Africa. Legitimate destruction by sportsmen has been comparatively a small feature.

The fur trade is now threatening to bring to a close the age of mammals which began three million years ago. The use of furs for protection has long since passed. Now it is fashion that demands them.

WEATHER RECORD ON TREE TWIGS

Science Service

SPRING weather records for the past ten to fifteen years can be read from the tiny twigs of many trees, according to reports from the Missouri Botanical Garden. Statistical study of scars left by bud scales on the branchlets of silver and Norway maples have shown the surprisingly great effect of climatic conditions on the amount of annual growth and indicate that the weather most favorable to the tree's development over a long period of years may be determined by such an investigation.

Scars are left on the twigs where growth starts each spring. The annual growth in length between these scars has been measured by the Botanical Garden experts for the past four years. From four to seven healthy, unbroken twigs from a large number of trees were used. Although some were large and others small, they all showed the same properties of growth for the same year. Climate is the only factor which, it is claimed, could have influenced all these differently situated trees, and, as the silver maples make most of their growth during a short period in spring, the twigs furnish an index to the weather of that season during the last four years. The figures show that 1919 and 1920 were good growing seasons while 1921 and 1922 were much less favorable. The scars disappear as the branch enlarges, but it is not unusual to find complete records for the previous ten to fifteen years.

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THE KIDNEY AS A FILTER

Science Service

THE kidney acts like an ordinary filter in removing waste products from the blood, Professor A. N. Richards and Dr. O. H. Plant, of the University of Pennsylvania, have discovered as a result of experiments which show that in the kidney there is a miniature microscopic filtration plant of extreme complexity.

The blood flows through the finely divided network of blood vessels in the kidneys to many thousands of microscopic filters. Since the blood passes over the heads of these filters under considerable pressure, some water and waste products pass through them, ultimately being excreted, while the bulk of the blood passes back to the main blood stream. Increase in the pressure of the blood on these filters increased the amount of waste products eliminated, just as increase of pressure on a water filter augments the flow of water through it.

In order to carry out such an investigation, it was necessary to develop microscopic instruments and a very fine technic. Although the filtration theory of kidney secretion has been held for years by physiologists, so difficult was the technic to prove it that not until the present time has it been satisfactorily verified.

INTERNATIONAL TELEPHONY

London Times

IN the address which he delivered as president of the Institution of Electrical Engineers Mr. Frank Gill gave some striking examples of the achievements of long-distance telephony. There is undoubted fascination, at least to the outside observer, in the idea of the secretary of state for India being able to speak from London to the viceroy at Delhi; yet, in fact, the direct distance is about the same as the length of a circuit in the United States, over which calls can be made regularly, and from what Mr. Gill said it appears that the construction of a line that would permit conversation between persons ten thousand miles apart is not technically beyond the present range of the telephone engineer. Mr. Gill's immediate purpose, however, was to urge the need, whether from the point of view of improving the relations between the nations, or for the ordinary purposes of commercial intercourse, of establishing efficient telephonic communication between the countries of Europe. Here the distances involved are comparatively moderate, and the difficulty is that the high-efficiency telephone circuit is an exceedingly delicate mechanism which is easily thrown out of balance and therefore requires a unity of design and operation that can not be expected from the forty self-contained telephone authorities of Europe. Mr. Gill suggests as a solution the formation of a company or commission, which, by arrangement with the governments, would take over the whole of the through business within and between the different countries. The establishment of such a body would obviously not be an easy matter, but probably it could be managed, provided that a sufficiently insistent demand for international telephony made itself clear. Difference of language is another obvious difficulty, but one which it is possible to exaggerate, though the telephone often seems to magnify peculiarities of speech so that, for example, a local accent, which is scarcely noticeable in face-to-face conversation, becomes well marked in the receiver.

ITEMS

Science Service

WHY loggerhead turtles readily find their way to the sea soon after hatching has been discovered by Professor George H. Parker of the zoological department of Harvard University. These reptiles are hatched inland and very soon after birth crawl out of their nests, he explained to-day. Then with a very few exceptions they immediately start their journey in the exact direction of the sea. Professor Parker studied this phenomenon at Miami Beach, Florida, and found at least three causes for the apparent ocean instinct of turtles. The most important reason for this behavior of the turtles is their tendency to go downhill, he believes. They also show an inclination to move toward regions in which the horizon is clear and unobstructed by large masses. And blue areas seem to attract them more than other colors. The path to the sea is usually slightly down hill and toward the blue sky in the open horizon. If suitable obstructions were placed in their paths, these turtles would crawl away from the sea just as regularly as they usually crawl toward it, Professor Parker explained. Their actions should be regarded more complex than a simple response to light, for the retinas of their eyes respond to the details, such as blue color, rather than to the image as a whole.

NINETY-EIGHT bushels per acre is the average yield of potatoes in the entire United States for the past ten years.

THE per capita consumption of meat in the United States has been increasing since 1915, with the exception of 1917, and it is estimated that the 1922 consumption will slightly exceed 150 pounds per person.

THE new Poland is more than half as large as Texas and its population is about a fourth as large as that of the United States.

SCIENCE NEWS

FORECASTING ICEBERG CONDITIONS

Science Service

ICE observation posts located on the bleak coasts of the far north would probably enable government experts to forecast iceberg conditions in the trans-Atlantic shipping lanes months in advance, Edward H. Smith, of the U. S. Coast Guard, said in discussing the work of the international ice patrol service since its inauguration ten years ago as a result of the *Titanic* disaster.

"The situation may be likened to that of a river," he explained. "Flotsam observed up stream in the current will later appear at the river's mouth. In this case the Labrador Current is the river whose mouth is in the vicinity of the Great Newfoundland Bank. The flotsam is the icebergs. It takes approximately five months for a berg passing Cape Dyer, Baffin Land, to appear south of the forty-fifth parallel. If a station could be located at Cape Dyer, or some other point along the Arctic drift where it sweeps in close to the shore, to report the number and dates of icebergs passing, it would prepare us to meet and deal with a situation about which to-day we lack advance information."

Some years produce large quantities of ice; other years brings scarcely any. In some years the ice is held up in high latitudes, in others it drifts far south. The ice observation posts might also serve as year-round weather stations, as the weather is one of the chief factors which determines the flow of the ocean currents and the melting of the ice. But great difficulty has been experienced in getting meteorological records from critical points on the Greenland and North American coasts on account of the lack of suitable weather observatories.

Describing the work of the ice patrol which was organized and placed under United States management by international agreement in 1913, Mr. Smith stated that "a continuous patrol is maintained by two United States Coast Guard cutters capable of keeping the sea in all kinds of weather. Each one alternately takes a two weeks' tour of duty and is then relieved by the other. When one of these ice scouts approaches the ice region, it collects all information from near-by vessels and proceeds to search the area south of latitude 43 for signs of ice, and broadcasts information as to the limits of the ice to all approaching vessels. In connection with this scouting duty, the Ice Patrol secures scientific observations relating to the ice area and forwards daily reports to the Weather Bureau.

One of the things brought out by the evidence gathered by these vessels is that there is no truth in the old idea that the cold Labrador current flowing south dives under the warmer Gulf Stream moving northeast and comes up again to the southward. When these two ocean currents meet the Labrador Current is arrested, then turned toward the Gulf Stream and finally pulled along in an easterly flow parallel to it.

A COMET'S TAIL

Science Service

A COMET'S tail one million miles in length pointed toward the sun instead of in the customary opposite direction is a remarkable phenomenon revealed by observations made at the Yerkes Observatory of a comet now far outside the earth's orbit. This is a peculiar and uncommon circumstance for which science at the present time can offer no very satisfactory explanation.

The object that exhibits this peculiar tail is called Baade's Comet, because of its discovery by Dr. Walter Baade, of the Bergedorf Observatory near Hamburg, Germany, in October, 1922. It is one of three faint comets visible telescopically in the sky at the present time, and in addition to its extraordinary tail it is of interest in that this is its first visit to the neighborhood of the sun, while both of the other comets now visible have been former visitors.

A comet usually is composed of a head containing a more or less eccentrically situated nucleus, and a tail pointing away from the sun. The tail increases in size and brilliancy as the comet approaches the sun, and diminishes or even disappears again as the comet recedes from the sun.

The tails of comets vary greatly in size and shape, but generally do not differ in direction. From the fuzzy oval head of the comet there is often, to be sure, a short fan-like formation spread toward the sun, but the main appendage is almost without exception on the opposite side. Only in rare instances do we find, as in Baade's Comet, a long tail directed toward the sun.

Baade's Comet when discovered was a faint hazy object without any tail whatever. It never got within two hundred million miles of the sun. It was photographed at the Yerkes and Harvard College Observatories and elsewhere, and carefully studied at many places in Europe and America until its orbit was determined. As the comet approached the sun it began to form tails, a short broad one in the usual position and an enormously

long narrow one pointing within twenty degrees of the direction of the sun.

Although this type of tail is difficult to explain, there is even for the usual kind of a comet's tail no entirely satisfactory theory. Comets' tails are believed to be composed of tiny dust particles which are driven in a glowing condition out of and away from the nebulous head by some force that issues from the sun. Whether this phenomenon is caused by light pressure, or electrical action, or some as yet undescribed force, astronomers can not demonstrate. Since the spectroscope was invented, the tails of sufficiently bright comets have been analyzed with that instrument, and much has been learned of their composition. But the cause of their existence remains a matter for intelligent speculation. The astronomers realize that any theory that purposes to explain comets' tails must also take into account this abnormal appendage of Baade's Comet.

DEATH RATES IN 1922

Science Service

THE death rate for the year 1922 was 8.8 per 1,000 lives and was the lowest, save one, ever recorded, according to statistics just compiled by the Metropolitan Life Insurance Company and announced through Science Service by Dr. Louis I. Dublin, statistician. This record is based on the mortality report of millions of industrial policyholders of that company which constitute over one eighth of the population of the United States and Canada. The facts revealed in this report are considered to afford the earliest reliable index of general health conditions in the two countries during the year just closed.

For the last six months of the year 1922, the record was the best ever shown for any half year in history covered by policyholder statistics. But considering the whole year, the record for the previous year, 1921, shows a death rate slightly lower, not quite one per cent. less. Had it not been for the outbreak of epidemic influenza in the early months of 1922, the year's health record would have been better than the minimum established in 1921.

The 1922 death rate for tuberculosis, 113.4 per 100,000, was the lowest ever recorded. Since 1911 the tuberculosis death rate has been reduced nearly one half. The mortality from this disease has been falling at a very rapid rate among the wage-earning group of the population and is continuing to decline year by year.

The year 1922 recorded the lowest typhoid fever death rate in the history of the insured. The figure was 5.6 per 100,000, a reduction of one sixth from the rate from 1921 and of nearly three fourths from the figure recorded in 1911. Pronounced improvement was shown in three of the four common communicable diseases of children, namely, diphtheria, scarlet fever and whooping cough. The measles death rate rose slightly. The year's record shows a reduced death rate for diseases related to child-bearing. The figures show that there is, nevertheless, much to accomplish in this very important field of health work. In the field of violent deaths declines were recorded for suicides, homicides, accidental burns and accidental drownings.

Increases were recorded in 1922 over the record of 1921 for influenza, pneumonia, organic heart diseases, diabetes, Bright's disease, cerebral hemorrhage and alcoholism. Among the violent deaths there were increases in the rates for accidental falls, machinery accidents, railroad accidents and especially automobile accidents. For the last named, the death rate increased in 1922 ten and seven tenths per cent., the 1922 death rate was nearly six times the rate for 1911; forty-eight per cent. of the deaths in automobile accidents were those of children under fifteen years of age. "The further rise in the automobile accident death rate is a challenge to the instinct of self-preservation of the American and Canadian populations," said Mr. Dublin.

The increases in 1922 for chronic nephritis and cerebral hemorrhage were slight. The diabetes rate increased 10 per cent. in 1922, and the figure for that year, 17.0 per 100,000, is the highest on record. The alcoholism death rate rose from 0.9 per 100,000 to 2.0, which is equivalent to a rise of 122 per cent. This is the highest alcoholism death rate since 1917, but is still much lower than the rates recorded for all years prior to 1918. Deaths from wood alcohol poisoning are not included in these figures.

CHEMICAL WARFARE AGAINST SHIPWORMS

Science Service

THE Chemical Warfare Service of the War Department has entered the fight to save our wharves and harbors from the attack of submarine enemies. Shipworms and gribble which annually do enormous damage by honeycombing piling and dock timbers are the foes against which knowledge of poisons gained in war will be directed.

Experiments will be made to find the best substance for impregnating timber which will be poisonous to shipworms after they have entered the wood and to find a substance which will prevent them from entering. It is proposed to stop the shipworm as it floats about in the water in the first stage of its growth from settling on the

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Dean, Yale University School of Medicine

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timber by altering the surface of the wood, so that they will not be attracted to it. They seem to be especially fond of fresh timber.

Means may also be found for poisoning the water in the vicinity of wharves so as to kill off the larvæ during the breeding season without seriously injuring any near-by fishing or oyster interests.

President Harding has designated C. H. Huston, assistant secretary of the Department of Commerce, as the governmental representative on the committee of marine piling investigations of the National Research Council, to assist in arranging for the cooperation of the Bureau of Yards and Docks of the Navy Department, the Engineer Corps and the Quartermaster Corps of the War Department, and the Department of Commerce with the Chemical Warfare Service in carrying on these marine borer investigations.

Shipworms when young start boring a hole in timber by means of the chisel-like edges of their shells. They continue to tunnel as they grow, passing the sawdust through their bodies to the outside. By impregnating the wood with creosote or other poison the shipworm career at tunneling is cut short in the treated timber since the wood is eaten. If the timber is untreated, a number of these mollusks, making it their home, may honeycomb and weaken it. As a result large timbers are often completely cut in two near the water line.

Gribble are small crustacea about the size of white ants and work with similar results.

THE HENRY DRAPER CATALOGUE

WORK has been begun at the Harvard College Observatory on the extension of the Henry Draper Catalogue, a compilation of the spectra of 225,000 stars, made over a period of many years as a part of the observatory's fundamental task of surveying and mapping the heavens.

Since the work of compiling the catalogue was undertaken, improved methods of stellar photography have made it possible to secure the spectra of fainter stars, and the new plan is to go for a second time over certain portions of the sky, adding the spectra of other stars than those already included. The work is beginning with a part of the northern Milky Way.

The extent to which this new survey supplements the original one is illustrated by the example of a single photographic plate recently described at a meeting of the American Astronomical Association. The plate covers a small part of the Milky Way where the stars are especially numerous, and it shows the spectra of 140 stars, only 14 of which had been included in the Henry Draper Catalogue.

As the spectrum of a star shows of what materials it is composed, such a catalogue is of fundamental importance to astronomers. The Draper Catalogue, containing as it does vast numbers of these spectra, is constantly used for reference in observatories. It consists of nine volumes. Of these, seven have been published to date, and meanwhile the observatory furnishes yearly to the astronomers of all countries upon request hundreds of spectra contained in the unpublished volumes.

The extensions to the catalogue will appear at intervals in periodical form. This new work will be in the hands of Miss Annie J. Cannon, of the Harvard Observatory staff, who has had charge of the classifications of stars from the Henry Draper Catalogue from the outset.

PRESENT STATUS OF "INSULIN"

The Journal of the British Medical Association

ABOUT one year ago it was announced that Banting and Best, working in the University of Toronto, had succeeded in isolating from the pancreas a substance capable of causing a marked reduction in the percentage of blood sugar and in the excretion of sugar in the urine of diabetic dogs. Since that time marked progress has been made in the clinical study of the preparation, but, unfortunately, uncontrolled newspaper announcements have given misleadingly exaggerated ideas of its possibilities. It is, therefore, well to have from Dr. J. J. R. Macleod, in whose department the work was conducted, an official statement concerning the present status of the use of this substance.

The original preparation prepared by Banting and Best was a saline extract of the residue of the pancreatic tissue remaining some weeks after the ducts had been ligated. It was shown that this active principle is soluble in alcohol, and J. B. Collip succeeded in preparing an extract that is practically protein-free and nonirritant on subcutaneous injection. Although it was possible to prepare the product on a small scale, early attempts to prepare it in quantities met with difficulties. Furthermore, investigations on animals showed that the product when taken in an overdose produces alarming toxic symptoms. This made it desirable in the interest of public safety to withhold general publication of the method of preparation and general distribution of the product until some satisfactory method could be found for preparing it in marketable quantities. The broadcast issuing of products of varying potency would result in contradictory and unsatisfactory results which would delay, if not prevent, an adequate understanding of the value of the

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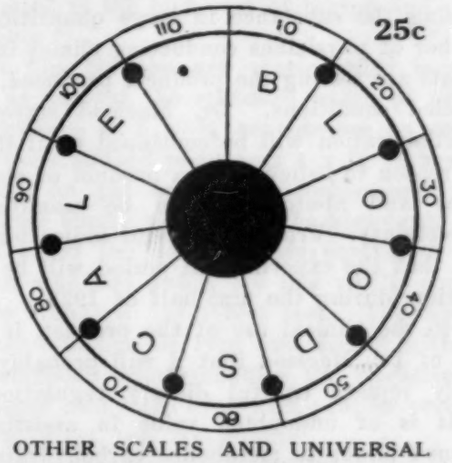

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substance, and might result in serious consequences.

The investigators have, therefore, applied for patents for their product in Canada, the United States and Great Britain, and have formally tendered the patents, when granted, to the University of Toronto. The university has accepted the trust on the understanding that the patents shall be employed for the sole purpose of safeguarding the production of the substance against commercial exploitation, and to insure the marketing of a standardized product. Dr. Macleod states that "the method by which the university intends to fulfil these conditions is to license approved manufacturers to produce "Insulin" under the patents subject to their satisfying the university by frequent submission of samples of their product that it is of adequate potency and purity." A royalty will be charged the licensees in order to maintain a testing laboratory, and any surplus income will be used for research. The original investigators receive no monetary return from the sales. In the meantime, several large commercial chemical houses are investigating the problem of producing the substance in large quantities, and a number of physicians conducting clinics in large hospitals are testing the products produced, under controlled conditions. Dr. Macleod states that this collaboration will be continued until there is every reason to believe that a product of standard potency and nontoxicity can be manufactured with certainty. From the present indications it is hoped that the experimental period will be ended some time during the first half of 1923.

As to the clinical use of the product, it is the belief of Dr. Macleod that it will probably never entirely replace careful dietary regulation, but that it is of undoubted value in assisting the weakened power to metabolize carbohydrate. The preparation, as made at present, must be given subcutaneously, usually in 2 or 3 c.c. doses twice daily; it is hoped that other methods of administration may soon be discovered.

These investigators and the university with which they are affiliated are to be congratulated on the methods they have adopted for controlling the production and the marketing of a product which holds large therapeutic promise. Such an investigation as they have outlined and are undertaking should be sufficient to show not only its value in the treatment of this hitherto very difficultly controlled disease, but also its limitations. It is to be hoped that when the investigations are finally completed the directors will also insist on controlling the advertising claims and methods of marketing, the fields in which the greatest abuses have crept in heretofore in connection with other proprietary substances. The conservative and scientific methods that have so far characterized the development of this new agent warrant the belief that the therapeutic claims will be so controlled

ITEMS

Science Service

MARINE animals are made partly of metal. Examination by Miss H. W. Severy, of Stanford University, of sixteen denizens of the sea from shrimps to whales has demonstrated that all contain zinc and most of them copper. For several years it has been known that copper is present in oysters and sometimes it occurs to such an extent that it colors them green and may even give them a metallic taste. Miss Severy showed that copper was also present in sea anemones, sea urchins, shrimps, crabs, salmon and sea-lions, but was absent in clams and whales. The average amount of copper found in these animals was about five parts in ten million while the zinc content amounted to four parts in one million. Certain animals such as the snake have long been known to have some copper in their blood which gave it the blue color. It acts in the same way the iron acts in the blood of higher animals: it is a carrier of oxygen to the tissues. The part zinc plays in the animal body has not been ascertained, although it is assumed that it functions as an aid to the digestive fluids. Zinc apparently is more widely distributed than copper, for the investigator found it in two higher animals belonging to the group of mammals, namely, the sea-lion and the whale; the latter showed no trace of copper in its body.

HOW strong is wood? because of disagreements and miscalculations as to the strength of lumber, which have resulted in accidents, the U. S. Forest Service, the American Society for Testing Materials and sixteen other organizations have appointed representatives to settle the question and work out standard tests for timbers. Detailed specifications for testing steel, cement and other products have been worked out, but the exact methods of learning the strength of wood have never been laid down.

THE Finnish state aeroplane factory recently completed its first machine built entirely, except the motor, from materials produced in Finland.

THERE are now 22 foreign and 15 domestic quarantines in force in this country aimed at controlling insect pests already present and guarding against the entry of others from abroad.

ONE THIRD of the nearly 6,000 forest fires started in the national forests of this country last year are directly attributable to the carelessness of campers.

SCIENCE NEWS

DOCK TIMBERS AND SEA WATER TESTS

Science Service

By testing the saltiness of harbor waters, engineers may be able to tell where the damaging shipworms, which annually destroy millions of dollars' worth of dock timbers in the ports of this country and Europe, will direct their attacks. Experiments made by H. F. Blum, of the department of zoology of the University of California, demonstrate that salinity often limits the parts of a bay in which certain species of these mollusks can live.

He has kept the *Teredo navalis*, a very destructive species of shipworm, in wooden tubs through which he ran San Francisco Bay water containing from time to time different amounts of salt. While there are species of shipworms which require the full amount of salt found in normal sea water, about thirty-five parts per thousand, Mr. Blum has found that these particular shipworms get along very well when there are only about nine parts per thousand or more of salt in the water, but that they do not like too much, the full amount in the water of the open sea. And he has found that these shipworms can stand for a while a salinity reduced to five or six parts per thousand, though their activity and boring is lessened and some of them die. But when the salinity is reduced below this amount most of the shipworms die in a few days.

This is very important in finding out whether this particular species of shipworm is likely to damage the piles of wharves in harbors where the water is made brackish by the fresh water from rivers. In such harbors where the salinity is usually about nine parts per one thousand or more, *Teredo navalis* may be expected to do a great deal of damage unless something else prevents its living. This pest is found in practically all European and American ports in the so-called temperate zone. Moreover, even if the salinity is reduced below this amount, the Teredo simply plugs up its burrow in the pile and waits until the next spring tide brings in saltier water and it can take another good drink. Even if freshets reduce the salinity to three or four parts per thousand during the spring and early summer months, a few of the borers, perhaps ten per cent., will live over and be ready to reproduce prolificly when the freshets are past and the salinity rises. Engineers say that these simple experiments lay the basis for predictions as to where trouble from these wood borers may be expected if tests of the salinity of harbor water are made throughout the year.

MOVIES IN THE HOME

Science Service

Movies in the home have been made practicable through the development of a new motion picture camera and projector that can be used by the amateur, according to Dr. C. E. K. Mees, director of the research laboratory of the Eastman Kodak Company here.

The new taking camera weighs only seven pounds and is said to be simple in operation. This reduction is obtained by the use of very small pictures and narrow width film. The special film and a carefully designed optical system have allowed diminutive apparatus without any serious sacrifice in quality of the pictures obtained.

"While the history of photography shows that most of the new developments have been due to the work of amateurs, the field of the motion picture has heretofore largely been closed to those outside the professional ranks. This has been due partly to the lack of suitable apparatus, but even more to the high cost of taking and printing the films."

The film for the new movie outfit is $\frac{11}{16}$ inch wide as against the standard width of $1\frac{3}{8}$ inch. The picture is 1 x $\frac{3}{4}$ centimeters as compared with the standard picture of 1 x $\frac{3}{4}$ inches. Five pictures on the small film consequently occupy the same length as two on the standard, so that 100 feet of the new film are equivalent to 250 feet of standard and a 400 feet reel is equivalent to the standard 1,000 feet reel. The film is of the non-inflammable type and coated with a special emulsion which enables the negative to be developed and then by a new process reversed to give a direct positive picture.

The lens is an anastigmat working at f. 3.5, permitting photographs to be made under poor light conditions. The finder is just above the lens and by an ingenious attachment changes the position of its image as the lens is focused. In this way the image is shown through the center of the field at all times. The lens has a focusing lever carried through to the back which can be focused for any distance from infinity to four feet. The diaphragm control is in the left hand corner and can there be read easily. In the center of the back is a footage indicator showing the quantity used, in feet. The crank turns nominally twice a second, taking pictures at the standard rate of sixteen per second. The camera is daylight loading, the film being supplied in a special magazine.

The new projector is motor driven and is entirely automatic in its operation. Once a film is

threaded the machine requires no further attention until the reel is exhausted. For home projection a lens of two-inch focal length is used, the picture filling a 30 x 40 screen at a distance of 18 feet and a 40 x 54 screen at 21 feet.

THE INFLUENZA EPIDEMIC

Science Service

THERE is more influenza this year than last year, but less than there was the year before last, according to telegraphic reports from all parts of the country received by the U. S. Public Health Service.

So far the epidemic has been comparatively mild in character, although there is a moderate increase in the number of deaths from influenza and pneumonia over the same period last year. December, January and February are the months in which the cases of the character now appearing are usually most frequent. Apparently there is now a considerable increase in flu during this seasonal period as compared with the same time last year, but the season of 1920-21 saw a smaller number of cases than this year.

Although the officials admit that the number of cases of influenza reported by the state officials may not give an accurate indication of the severity of the disease, the statistics show that the disease has been reported more frequently this year than last in Massachusetts, Connecticut, New York City and State, New Jersey, Illinois, Wisconsin, Missouri, Nebraska, Delaware, Maryland, District of Columbia, Georgia, Florida, Kentucky, Alabama, Arkansas, Louisiana, Texas, New Mexico and California. Reports for the two weeks ending January 20 also show a considerable number of cases present in Mississippi, West Virginia and South Carolina, but the data for last year are lacking. Many states do not make reports, and the conditions in those areas are not shown in the Public Health Service reports, while many respiratory conditions resembling influenza and variously termed grippe, bronchitis, severe cold, laryngitis are often called influenza.

The medical profession has not been able to settle on a clinical diagnosis of influenza, except in very severe cases. There is a very "widespread prevailing sickness," but most of the mild cases and some of the severe cases are never reported at all.

In years when the disease becomes pandemic, as occurred during the war, the origin and spread of influenza can be traced as it spreads along the ordinary lines of travel apparently from a definite area. During the 1918 epidemic officials were able to predict the course of the epidemic so accurately that in some cases hospitals were prepared several weeks in advance of the disease.

In years like the present, when the epidemic is comparativly mild, it is more difficult to trace its origin and spread. This suggests the possibility that there may be two different diseases which are both known by the name of influenza.

OCEAN LANES FOR TRANS-PACIFIC SHIPS

Science Service

STEAMSHIP companies will soon have to "double-track" the Pacific ocean to avoid traffic accidents, in the opinion of the Hydrographic Office of the U. S. Navy, which has announced the best eastbound and westbound routes for ships to take throughout the year.

Trans-Pacific shipping has greatly increased in the last few years, and in the near future it will be essential to safety that the steamship companies enter into an agreement making it mandatory upon the masters of vessels to follow definite routes, instead of going in any direction they wish as at present. To meet this condition, the Hydrographic Office has made a careful study of distance, storms, prevailing winds, fogs and ocean currents, and recommends the lanes for both directions between Puget Sound and Yokohama, San Francisco and Honolulu and Honolulu and Yokohama.

These steamship tracks are for all the year round. In the North Atlantic, where such routes have been followed for years, there is a shift during the iceberg season to a more southern route. The ships running between Puget Sound and Yokohama, however, do not have such dangerous ice conditions and one route can be followed all the year around.

The eastbound track from Yokohama to Puget Sound as laid down by the Hydrographic Office takes advantage of the Japanese current, while westbound ships are routed so as to strike the weaker inside edge of the current.

The recommended routes between the northern ports is the shortest practicable distance and runs south of the Aleutian Islands. The shortest actual distance would, of course, be along the great circle, but this leads through the Aleutian Islands and is impracticable on account of fogs, ice and treacherous currents.

EARTHQUAKES AND VOLCANOES

Science Service

MOST of the new islands of the Pacific that have arisen from the depths during the memory of man are volcanic in origin, and as no volcanic activity, so far as known, was associated with the recent earthquake in the Pacific, Professor W. J. Humphreys, in charge of seismology, U. S. Weather Bureau, at Washington, believes that there is little probability of new islands having been formed.

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Each class is limited to 75 students, men and women being admitted on the same terms. **Except in unusual circumstances, applications for admission will not be considered after July 1st.**

If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

Contrary to the common belief, major movements of the earth's crust and volcanic eruptions are not related, although volcanoes and earthquakes often occur in the same region, though usually not at the same time. The two kinds of geologic activity occur in the same region because both are characteristics of relatively new portions of the earth.

A severe earthquake, such as the recent one, would be accompanied by a slip of only a few feet in the ocean floor, whereas a great volcanic eruption which would pile up hundreds of feet of material would probably be necessary for the formation of an island. But while earthquakes do not cause volcanic eruptions, volcanic eruptions may produce slight tremors in the earth in much the same way as boiling water makes a kettle vibrate.

THE "SHORT-CIRCUIT BEETLE"

U. S. Department of Agriculture Press Service

BEETLES which bore through lead cables, and which, nevertheless, do not or can not penetrate pure gum rubber, have proved a serious problem and pest in California and many other parts of the United States. One of the most important injuries inflicted by these beetles is the damage done to the lead sheathing of telephone cables in California. The beetles bore circular holes in the sheathing, about one tenth inch in diameter. Moisture enters the cable through these holes, causing a short-circuiting of the wires and interruption of service to the public. As one hole may put from fifty to six hundred or more telephones out of use for from one to ten days, the damage is rather extensive.

Experiments have been undertaken at various times, by the Bureau of Entomology of the United States Department of Agriculture, to determine what treatment could be used to keep the beetles from injuring the cables. These experiments are summarized in a professional paper, issued as Department Bulletin 1107, "The Lead-Cable Borer in California," by R. D. Hartman, H. E. Burke and T. E. Snyder, entomologists. Thus far the results indicate that the beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellent placed on it. Probably it is able to penetrate the poisons because it does not feed as it bores through. Beef tallow, when sufficiently soft, will stick to the beetle and suffocate it, and has been used with some success on the rings which suspend the cable, since practically all the boring is done near the rings. Layers of friction tape impede the boring and thin sheets of copper, zinc and steel prevent it. Sleeves of these metals can be placed around the cable at the rings, but the cost would probably be too great for general use. A new type of ring made of flattened steel-wire stock galvanized is now being installed by the telephone companies, and it is believed that this ring is better from the standpoint of preventing attack by the beetle than the old one. Meantime, tallowing the rings is the most promising method of control.

COLOR OF PAINT IMPORTANT FACTOR IN FOULING SHIPS' BOTTOMS

The Fisheries Bulletin

SOME interesting results have been obtained by J. Paul Visscher in his study of the fouling of ships' bottoms. These results indicate that the color of the paint used is an important factor in determining the amount of fouling. A series of plates painted with different colors were exposed in sea water at the Beaufort laboratory, and the development of the growths was observed over a period of several months. The plates were identical except for the color used, and since all factors influencing them were the same it may be concluded that any difference in the amount or the nature of fouling was dependent on color. These colors included white, black, yellow, red, green and blue. The results show clearly that there was much more fouling on the dark plates than on those with lighter colors. The contrast between the white and black plates was especially marked. Barnacles, which constitute a large percentage of the total amount of fouling, were especially affected by color. They were found only on the blue and black plates and were most abundant on the black. Hydroids were also practically confined to the dark plates.

The results are apparently explained by the factor that, at the time of attachment of the larvæ to these forms, the organisms are negatively phototropic, that is, they tend to go away from the source of light. This experiment is in accord with observations made on the growth on ships' bottoms where the densest growths are found in regions least exposed to light. The notes and tentative conclusions are at present based on a limited amount of evidence, and it is expected that the problem will be more thoroughly investigated through experiments in which many of the less-known factors may be more definitely controlled.

SLEEPING SICKNESS

London Times

LAST night, at the Royal Society of Tropical Medicine and Hygiene, there were submitted two

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By SIMON H. GAGE of Cornell University

13th Edition, Published December, 1920

In this edition, special emphasis is put upon the Dark-Field Microscope. POSTPAID $3.00.

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GEO. M. GRAY,
Curator, Woods Hole, Mass.

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

AMERICAN SCHOOL IN FRANCE OF PREHISTORIC STUDIES

Archaeological Institute of America

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Three scholarships for the year 1923-1924 are available.

Applicants should have some knowledge of prehistoric archaeology, not necessarily in the European field, and some acquaintance with French; a long course of preparation is not absolutely necessary.

The work of the School begins July first of each year, and continues for one year.

The time is divided between excavations, excursions and study in museums. This is supplemented by attendance at lectures given by French scholars and by the American Director.

Those who consider entering the school, whether or not applicants for scholarships. and whether or not intending to pass the entire year in the School, should address the chairman as soon as possible.

GEORGE GRANT MACCURDY,
Chairman

Yale University Museum
New Haven, Connecticut

papers of immediate practical importance on the treatment of African sleeping sickness. One of these dealt with the German synthetic drug known as "Bayer 205," which has now been employed by competent observers in this country in nine cases of sleeping sickness occurring in Europeans. Of these nine cases eight were infected with the organism known as *T. Gambiense*, one with that known as *T. Rhodesiense*. The latter patient died with active trypanosomes in his blood, in spite of having received many large doses of the drug. On the other hand, seven of the eight patients infected with *T. Gambiense* made what appear to be rapid and complete recoveries. Two have remained quite well for over a year without receiving further treatment. The eighth case died, but he was very far through when treatment with "Bayer 205" began, and after death the micro-organisms were found in his brain, to which area, probably, the drug is unable to penetrate. He died with brain symptoms.

The conclusion would appear to be that this German secret drug is indeed very potent in the treatment of at least one form of sleeping sickness. The second paper which was read last night deals with a preparation made in the Rockefeller Institute and called Tryparsamide. This drug seems to have given admirable results, and though it has been tested less widely than the Bayer preparation, it may well be that in process of time it will rival or excel it.

Thus, in a world distracted by schism, Science pursues the object of her great "international." She has no frontiers and recognizes none. Her sons and daughters build each on the foundations of the other, counting it the highest honor to be the servant of all. "So," perhaps, "shines a good deed in a naughty world."

GROWTH OF THE DESERTS

The London Times

WHATSOEVER be the cause, there seems to be a secular expansion of the desert belt, at least in the Northern Hemisphere. The rocky gorges of the Nile cataracts bear testimony to the passage of water on a scale much larger than any at present. The Sahara is scarred and seamed with old watercourses and the dry beds of lakes, and there is similar evidence from Arizona, New Mexico and Asia.

Colonel H. de H. Haig, in the current number of *Discovery*, reminds us that the deserts were the centers of past empires. The great nations of antiquity—Assyria, Babylonia, Persia, Phœnicia, the Hittites, Egypt and Carthage, the Aztecs and Incas—all flourished in lands now without sufficient rainfall, but which, with abundant water supply, would easily produce two crops annually.

The old caravan road from Tripoli to Lake Chad now passes through a waterless desert, but all along its length shows the remains of Roman stone buildings, wells, walls and paved roads. In Roman days North Africa was a vast granary, with numerous and wealthy cities, and an old Arab saying relates that it was once possible to walk from Mecca to Morocco in the shade. Mesopotamia was once the most fertile region on the earth, and its possession gave power and wealth to many great kings. Persia, now largely in the desert region, achieved wealth and civilization thousands of years ago, and was a conquering power at the dawn of Greek history. Sven Hedin and Sir Auriel Stein have reported the presence of extensive ruins, temples, shrines and mummies in the Gobi deserts of Central Asia, in regions that are now waterless. It seems a fair inference that the homes of old civilizations, so many and so great, could not then have been in their present desert condition.

Colonel Haig advances the theory that the world is actually drying up, more and more quantities of water being locked up in the depths of the earth as vegetation turned into minerals or by direct chemical combination. It is not possible to sink a deep shaft for a mine without encountering water, and he doubts if the bulk of such buried water is ever brought into active circulation again. This conclusion, however, is not inevitable. Even the deepest mine or boring penetrates only a small part of the total depth of the sedimentary rocks. The slow changes which elevate or depress the edges of continents, raise mountain chains, and sink rift valleys probably strike far deeper than the subterranean stores of water. The surface of the wide oceans gives an almost limitless field for evaporation. It is more probable that the present phase of growth of the northern desert band is only the slow swing of a long-period pendulum.

ITEMS

Science Service

THE more advanced Aztec and Inca tribes had acquired considerable knowledge of dyeing and other chemical operations long before the discovery of America by Columbus.

IRON was first made from iron ore in the American colonies at Jamestown in 1608.

MORE than forty different species of mosquitoes are known to occur in New Jersey.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

A NEW CHEMICAL ELEMENT

Science Service

CLAIMANTS of two nationalities dispute the honor of being the discoverer of one of the six missing chemical elements that scientists have confidently predicted will some day be isolated.

The disputed position in the periodic table of chemical elements is known as Number 72. Professor G. Urbain, of the Sorbonne, announced some years ago that he had identified and isolated a new rare earth element that he called "celtium" as a tribute to the French or Celtic race. Professor A. Dauvillier within the last few months has announced to the Paris Academy of Sciences that he finds by X-ray spectroscopy of rare earth mixtures that Urbain's celtium fits into the gap in the known elements where Number 72 should be.

But from Denmark comes the counter claim that element 72 is not a rare earth metal, like cerium and thorium, whose oxides are used in gas mantles, but an element very similar to the metal zirconium. D. Coster and G. Hevesy, of the Copenhagen Institute for Theoretical Physics, have investigated the spectra obtained when extractions from zirconium minerals are made to produce X-rays and they have found lines in the resulting spectrum, hitherto unknown, that correspond to those that element Number 72 should have. But the lines found by these Danish scientists are not the same as those found by the French physicist and chemist. The Danes have patriotically proposed that the new element they have announced be named "hafnium," derived from Hafniæ, meaning Copenhagen.

If the discovery of Dr. Coster and Dr. Hevesy is confirmed, hafnium may sometime be found in considerable quantities, as they report that "in a Norwegian zirconium mineral the new lines were so intense that we estimate the quantity of the element 72 present in it to be at least equal to one per cent." They believe that ordinary metallic zirconium contains at least one hundredth to one tenth of one per cent. of the new element. Experiments are under way to isolate this new element and determine its chemical properties as it is at present known by its spectrum alone.

If, on the other hand, the claims of Professors Urbain and Dauvillier are substantiated by time, Professor Urbain will have the credit of discovering two of the 92 possible chemical elements, a unique distinction. He previously discovered and isolated lutecium, naming it in tribute to his native city, Paris, known in ancient times as "Lutecia."

Many of the chemical elements have been first discovered in the spectrum and then found and isolated by chemical means. Helium was discovered in the sun in 1868 by lines seen in the solar spectrum and not until 1895 was it isolated by Sir William Ramsay. The X-ray spectrum of a substance under investigation is much more certain of interpretation than an ordinary light spectrum because the positions of its lines are directly and simply related to the arrangement of its elements in what is called the "periodic table." Moseley, the young British physicist who was killed early in the war, was able by applying X-ray spectroscopic methods to arrange the known chemical elements in an orderly series according to their atomic numbers. This classification is much more enlightening than the periodic table devised by the Russian chemist, Mendeléef, in 1869. Moseley's work showed that there are spaces for several elements that man does not yet know and among them was Number 72. Numbers 43, 61, 75, 85 and 87 are still missing, but by their positions in the series, scientists have predicted the properties of the unknown elements. The position of 72 in the series is such that it must be related both to the rare earth metals and to the metal zirconium, so the theoretical data do not help in deciding the present scientific controversy.

WASTE WOOD PRODUCES CHARCOAL AND ALCOHOL

AFTER hundreds of unsuccessful attempts have been made to utilize small waste wood in the carbonization and wood distillation industries, Professor O. E. Stafford, a University of Oregon man, has perfected a process that is commercially successful. A superior grade of charcoal and wood distillation products used in a number of basic industries can be obtained from mill waste under his process.

Professor Stafford first demonstrated his process scientifically on the University of Oregon campus. He and the firm of engineers behind him have now succeeded, after several years' labor, in demonstrating it as a practical commercial process. Two wood distillation plants on the Atlantic Coast, one of them controlled by a big corporation, placed every resource at Professor Stafford's disposal, and the success of the process was completely demonstrated.

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The Microscope

By SIMON H. GAGE of Cornell University

13th Edition, Published December, 1920

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as dye, paints, varnishes, celluloid, smokeless powder and artificial leather. A considerable amount of charcoal is used in the chemical industry; for example, in case hardening steel. Bagged charcoal is consumed extensively in many large cities. Charcoal briquets are in demand as fuel.

Cord and slab wood have been the accepted material used in making charcoal and its by-products. As small waste wood is materially cheaper than either slab or cord wood, the desirability of utilizing it in carbonization operations has long been recognized. Eight hundred applications have been made at various times at the Patent Office by those who thought they had hit upon a process of carbonizating small waste wood on a commercial scale. The failure of these efforts, up until the Stafford process was proved successful, has been due, in general, to heavy costs of installing and maintaining the complicated mechanical appliances required.

In 1920 after experimental demonstrations at Cambridge, Mass., work was continued in a plant of two hundred cords daily capacity at Kingsport, Tenn., which had originally been erected by the National Research Council during the war for chemical experimentation.

The commonly accepted practice of carbonization is to place cord or slab wood in large oven retorts made of steel plate. Fires in the furnaces beneath are started. Vapor outlets from the oven are provided, these outlets leading to condensers for the recovery of the liquid products of the distillation. The charcoal is withdrawn after the wood has been carbonized.

The retort used in the Stafford method is a cylinder thirty-two feet high and nine feet in diameter. The cylinder is set vertically and the appliances are such that the wood to be carbonized is fed continuously into the top, while charcoal is withdrawn continuously from the bottom. A remarkable feature of the process is that no heat is applied to the cylinder after the process once is started, the carbonization of the wood being spontaneous under the conditions which the invention maintains.

In previous processes the principal difficulty encountered in the use of small waste wood has been that of transmitting heat to the interior of a mass of finely divided woody material in the retort. Such a mass is a poor conductor of heat. Only the portions of it in contact with the hot walls of the retort can in any reasonable time reach a carbonizing temperature. The numerous attempts to handle such material have had to do principally with overcoming this difficulty.

Formerly, the wood used in carbonization work has always contained moisture. But Professor Stafford experimented with perfectly dry wood. He found that when the dry wood is heated under his process to the temperature at which the charring begins the carbonization went along to completion without further application of heat from outside sources. This is referred to by chemists as an exothermic process.

The cost of installing a plant under the new plan is considerably less than that of building an oven retort plant of equivalent capacity. It has other advantages, among which are low depreciation and low labor and fuel costs as compared with other systems. It has not yet been demonstrated whether the charcoal made under the Stafford process can be used in the iron industry. The charcoal produced from small waste wood would have to be briquetted for direct use.

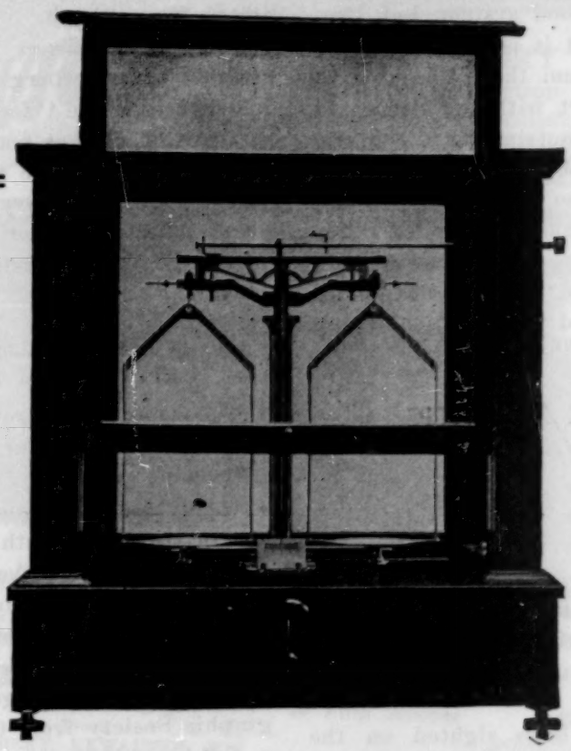
In the working out of the Stafford process in the Pacific northwest, Douglas fir would be the most available species of wood. It occupies an intermediate position between the hardwoods and the soft or resinous wood, such as the southern long leaf pine. Hardwoods give a high yield of wood alcohol and acetic acid, while the southern pine gives low yields of alcohol and acid but a high yield of turpentine oils and resins.

THE CAPILLARIES

Science Service

If the blood vessels of an average sized man were placed in a straight line continuously, they would reach around the globe two and one half times, Professor August Krogh announced at Yale in the Silliman Lectures, which have just been published in book form under the title "The Anatomy and Physiology of the Capillaries." Professor Krogh's researches upon the capillaries at the University of Copenhagen, Denmark, during the last decade won for him the Nobel prize in 1920.

Capillaries, which are the numerous microscopic blood vessels that join the arteries bringing blood from the heart to the veins which take the blood back to the heart, Professor Krogh believes to be the most important part of the blood system. Although the capillaries are very small, their great number affords a large surface so that the blood may easily furnish nourishment and oxygen to the tissues and readily remove the waste products from them. Professor Krogh has calculated that the surface of these minute blood vessels in an average man equals the area of a city block. Their number is so great, according to this investigator, that in a single piece of muscle with the cross section the size of an ordinary pin there would be eight hundred of these microscopical capillaries besides two hundred muscle fibers.



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The capillaries have always been regarded as unimportant parts of the blood system, but Professor Krogh points out that it is only while the blood is passing through them that it is able to come in close enough contact with the tissues to actually furnish them with nutriment. Each one of these capillaries has a separate nerve of its own which enables it to close or open depending on the condition of the tissue it supplies. For example, when a muscle is being worked and needs considerable food and oxygen, nearly all the capillaries will be found open, while during rest a number of them will be closed.

ICEBERGS IN THE ATLANTIC

Science Service

ICEBERGS will soon menace Atlantic traffic, Edward H. Smith, stationed on Coast Guard cutter *Senaca*, told a conference of the principal trans-Atlantic steamship managers held in New York on February 15. He is the man who, from a ship at sea, answers all requests from steamer captains for ice information during the danger season.

"Already field ice has been sighted on the Grand Banks of Newfoundland and it will soon stretch south," he said. "Two Coast Guard cutters, *The Tampa* and the *The Modoc*, fine new electric drive vessels capable of keeping the sea in all kinds of weather, have been detailed for ice patrol this spring. *The Tampa* in Boston is now preparing for her duty and will be ready to proceed as soon as the first of the 1923 icebergs appear off the Grand Banks. We will be on the job continuously until next July, when the danger of a berg drifting on the steamship tracks is quite remote."

He described the work of the international ice patrol undertaken by the United States government for the past ten years. The navigation experts were also told how bergs are formed and carried into the ship lanes by the ocean currents.

As a rule field ice appears off the east coast of Newfoundland the latter part of January, coming down in a narrow strip fifty miles or so wide, Mr. Smith said. By the latter part of April, the banks are entirely free of this field ice, which melts quickly in the lower latitudes. The berg ice carried down by the Labrador Current lasts until July.

Mr. Smith described how the patrol kept in touch with ice conditions, charted the drift of bergs and broadcast warnings. Commenting on the mistaken notion that the patrol destroyed the bergs, he told of measuring one berg which rose 248 feet above the water and extended 1,690 feet. There was enough ice in this one berg, he estimated, to fill every refrigerator in the United States for a month.

There is no means yet devised by which the presence of an iceberg can be detected during fog or darkness. The "feel" of the air and the temperature of surface water are unreliable, he said, but he held out hope that the sonic range finder developed by the navy can be perfected to give sound reflections from icebergs that will result in knowledge of the distance and direction of the danger.

A LEAGUE OF INDIANS

The National Geographic Society

WITH the newly-revealed wonders of Chaco Canyon replacing our boyhood thrills at Chingachcook's exploits, and the Pueblos plunged into politics, we frequently ignore the remarkable Indian tribes of South America.

To-day, in Chile, lives the most numerous of all Indian tribes surviving in the Americas, the Araucanians, who retained their independence longer than any other natives of the western hemisphere. Writing to the National Geographic Society from Chile concerning his people, a full-blooded Araucanian Indian says:

"For more than three hundred years we waged war with the Spanish. The Araucanians, Araucanos, Nguluches or Mapuches, or whatever you may desire to call this virile race from which I sprang, is formed by four big groups of tribes: Pewenche, the people of the pine trees; Williche, the people of the south who occupy the mainland; Puelche, the people of the east, and Picunche, the people of the west.

"When in 1536 Don Diego de Almazio discovered Chile or Southern Land, unknown until then, and later in 1541 when Pedro de Valdiva conquered Chile, the Araucanians took their first step toward forming a league of clans comprising some two or three hundred people.

"In case of imminent danger, a war chief, Toki, was chosen by a general council. The election of a Toki was based upon the good health or strength of the man. The individual who could hold a heavy stump over his shoulder the longest was chosen as the Great Caupolocan.

"Zuniga, the great Spanish writer of the Golden Century of Spanish literature, commemorates the early heroism of my people in his famous 'epic' known as 'la Araucana.' He mentions the great chief Keupulikan or Caupolican, and his wife Guacolda who, when later imprisoned by the Spaniards, denied her marriage to him. Here we see that Arauco did not only have men leaders, but also women. Keupulikan, whose name means 'by divine conception,' has been re-

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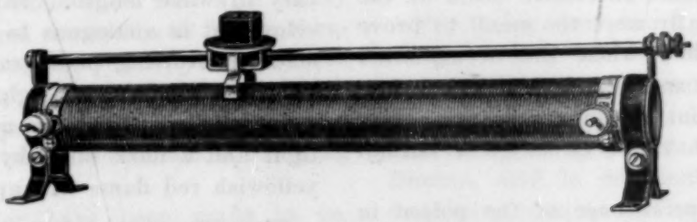

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WRITE FOR ILLUSTRATED DESCRIPTIVE BULLETIN 980.

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membered by all the Chilean citizens aa a national hero who fought for the defense of his life.

"In 1641 the King of Spain conceded to the Araucanians their independence, which was confirmed in 1655.

"A treaty was signed in 1876 with the Chilean government which had been formed in 1810. Temuco or Temu (Temu, 'tree') is where the great Colipi and General Urrutia, the general of the Chilean army and the Lonko of Arauco shook hands and agreed to build a city and to develop the natural resources of the Araucanion domain.

"My people call themselves Mapuches, which means people of the land, or that they are native there. All the Indians have their own reservations, but the fact that they live there in no way restricts their right to vote when election comes. In this they may be contrasted with the North American Indian who must give up his reservation to be a citizen."

THE VENOM OF THE COBRA

Science Service

THE body apparently does not produce an antitoxin to combat the deadly venom of the cobra in the same way that it fights the poison of the diphtheria germ, Professor A. R. Cushny, of the University of Edinburgh, concludes from experiments which he has just completed. When he attempted to accustom rabbits to the poison of the cobra by giving them successive doses of the venom which individually were too small to prove fatal, the animals died when the accumulated amount of the poison was equal to a lethal dose even though the amount administered just before death ensued would have no effect on a normal animal.

"Evidence of the persistence of the poison in the tissues could be obtained in some cases a month after the injection," according to Professor Cushny. "This gives rise to no symptoms, but the animal succumbs to a subminimal additional dose." He also believes that it is probably held in the nerve ends since he could not find any trace of the toxin in the blood.

In the case of diphtheria toxin, the body can make a substance capable of destroying the poison if the doses of toxin administered are given in very small amounts at first and the dose is gradually increased. The subject finally becomes so immune to the toxin that a dose which would kill an individual who was not treated this way has no effect on the person who has the abundance of antitoxin in his system.

The cumulative action of cobra toxin shows that an antitoxin is not produced to counteract this poison. Lead and mercury compounds produce a similar cumulative action in that fatalities are caused by an accumulation of either of these substances by continued small doses, each of which taken alone is harmless, but when taken repeatedly become deadly.

ITEMS

Science Service

X-RAY movies have been brought a step closer and fine details in bone structure have been revealed by the use of a new method of photographic plate sensitizing developed by Dr. C. Scheussner, of Berlin, according to information reaching the American Medical Association. By incorporating a radioactive substance with the light sensitive substance of the roentgenographic plate or film, he has been able to record certain wave lengths of X-rays that have never been photographed before. The radioactive substances placed in the emulsion emit their own rays when the X-rays come in contact with them. The result is described as startling. The negatives made by the new method bring out all the finer details in the structure of the bones, which otherwise can be observed only in the sawed ends of the bones themselves. It is hoped that injuries and pathologic changes that the ordinary X-ray plate is blind to will be recorded. There are different kinds of X-rays, varying in length, just as there are different colors of visible light, which also vary in wave length. This new X-ray plate development is analogous to progress that has been made in evolving photographic plates sensitive to red, yellow and green light. The ordinary photographic plate is sensitive mainly to blue and violet light and a dark blue sky will look white and a yellowish red flame will appear almost black.

WATERPROOFING of the bed and banks of the river Nile to prevent loss of water by seepage into the desert sands has been proposed as a means of helping stop the apparent spreading of the desert. The Sahara is scarred and seamed with dry beds of once refreshing lakes and other evidence that the water supply was formerly more abundant than at present. The Nile loses by evaporation and by seepage into the porous soil. The shortage in the last few seasons has cut down rice raising and there is little prospect for anything better the coming year. By converting the river into a waterproof canal along its course through the desert, more of the precious water could be saved for use where most needed.

THE Isle of Pines gets its name from its forests of pine trees said to exist there at lower altitudes than anywhere else in the tropics.

SCIENCE NEWS

FOG REMOVAL AND RAIN MAKING

Science Service

How fogs are being removed and how rain will be caused to fall by electrically charged sand was explained in a statement made to Science Service by Professor Wilder D. Bancroft, of Cornell University, authority on colloid chemistry, who with L. Francis Warren has been conducting experiments at McCook Field, near Dayton, Ohio.

Clouds consist of drops of water too small to fall at appreciable rate. Drops are kept from coalescing either by being charged electrically and therefore repelling each other or by being covered with a film of condensed air acting like a gelatine capsule. Spraying with positively charged sand will cause negatively charged drops to coalesce and will also remove film of adsorbed air to some extent. The first is the principle involved in precipitating electrically-charged colloids and the second occurs when the crystal detector is used in wireless. The large drops fall and carry down with them many of the finer drops just as the coarser particles of butter fat in milk carry up many of the finer ones when cream rises.

The new process invented by Mr. Warren sprays electrically charged sand from above and consequently gets more results for same expenpenditure of power the thicker the cloud. Experiments at McCook Field show that with eighty pounds of sand charged nominally to fifteen thousand volts a cloud covering two square miles can be dissipated in less than ten minutes. Much better results are expected with sand charged to thirty thousand volts and a more efficient charging nozzle.

Experiments so far have been made in cooperation with the Army Air Service to demonstrate feasibility of removing fogs from flying fields as aviators can neither go up nor come down safely in fogs. Experiments to be made at Moundsville will use a captive balloon one thousand feet up to spray the sand and clear the field. Flying fields can certainly be kept clear and results look encouraging for clearing New York harbor when necessary. Successful preliminary experiments have been made with smokes; but nothing has been done with fogs containing smoke. The problem of removing London fogs seems much less visionary than it did one year ago and is now a question of efficiency.

The Army Air Service is interested in fogs, not rain, and no experiments on rain-making have yet been made. The clouds attacked so far have contained very little moisture. The problem of obtaining rain from heavy clouds should be much easier than dispersing fogs. No claim is now made that rain can be obtained from a clear sky. In many of the arid regions storm clouds pass over without raining. These can undoubtedly be made to rain. With a rain cloud one mile thick the necessary expenditure of power will be the same as with a cloud three hundred feet thick, but the amount of rain will be very much greater. The problem of rain-making and of fog dispersal consists in making small drops into large drops by coalescence and is not a problem of condensation. Since a cloud is an instable mass which should rain but does not, we are not dealing with gigantic forces of nature. The commercial success, if it comes, will be due to the fact that the development of the airplane has made it possible to attack clouds from above and to take advantage of the sweeping action of the falling drops. No one has ever considered rain-making as being colloid chemistry and not meteorology. One distinguished meteorologist pointed out in his book that it was very difficult to see how the drops in a cloud became large enough to fall; but he admitted that it does rain—which nobody can deny.

HOW NATURE MAKES RAIN

Science Service

THE more dust there is in the air, the less chance there is of rain, but the popular idea that dust particles are necessary for rain formation is not altogether wrong, Dr. W. J. Humphreys, meteorological physicist of the U. S. Weather Bureau, said in commenting on the recent fog dispersing tests at McCook Field.

Rain occurs because many very small particles of moisture that form the cloud or fog are brought together to make big drops that have sufficient weight to fall to earth. In a cloud there is usually a superfluity of dust particles. Each little fog particle has one or more dust particles all its own.

Rain formation begins by rising moist air expanding and becoming cooler as it reaches the upper levels of the atmosphere. The first portion of the rising air forms a cloud by condensation of its moisture. Then when the ascending air hits this cloud, many of its dust particles are strained out by the lower layers of the cloud. And as it cools by further rising the air that was warm can not hold all the moisture that it carries. More of it condenses out, and each

newly formed droplet goes in search of something to cling to. Some of them find unsurrounded dust particles, but many more find the dust they covet already occupied by a droplet of water that is still light enough to fall very slowly. In fact, every particle that makes up a cloud is always slowly falling. When the new water joins with that already there, the combination becomes heavy and the drop of rain plunges downward to earth, often carrying with it other smaller drops. Below, the people say: "It is raining."

The scattering of plain dust or finely powdered material in the upper air to serve as nuclei for the raindrops was declared by Dr. Humphreys to be absolutely absurd in view of the way in which rain forms.

But the scattering of electrified sand for the dispelling of small strips of fog, such as has been done at McCook Field, he believed might prove of value in military operations where expense is no consideration.

Any electrified object might attract to itself minute particles of moisture in a fog and carry them down with it. This clearing of the air would take place only in the area in which the sand or other electrified objects were falling. Such a method could not be carried out on a large enough scale to produce an appreciable amount of rain.

GERMS CAUSING TEETH DECAY

Science Service

BACTERIA capable of causing tooth decay or dental caries have been discovered and isolated here at the U. S. Army Medical School by Dr. F. E. Rodriguez, captain, dental corps.

This accomplishment is declared to be the greatest step toward getting at the real bacterium of dental caries that has been taken in the last three decades since the American dentist, Miller, established the assumption of the German bacteriologist, Koch, that tooth decay is caused in some way by bacteria.

Dr. Rodriguez told in an exclusive Science Service interview how he isolated three types of bacteria with an exceedingly high acid-producing power, capable of dissolving the hard lime of the tooth and migrating into the deep tissue. He subjected teeth to pure cultures of these organisms and these teeth developed spots similar in all respects to the usual decay of teeth. Through accurate microscopic work he demonstrated that these same bacteria penetrate into the deep layers of the teeth, and he found these particular types of bacteria far beneath the softened discolored decayed portion.

"Dental decay is essentially a disease of youth and nine tenths of our school children are afflicted," said Dr. Rodriguez, in discussing the seriousness of the dental decay problem. "The effects of dental decay are permanent throughout life."

In addition to experimenting with the tooth decay bacteria, Dr. Rodriguez placed teeth in pure cultures of other bacteria of the mouth and found that these were unable to produce decayed areas.

The three forms of tooth decay bacteria are different morphologically, he found, but their physiological activities appear to be similar. Dr. Rodriguez believes that it may be that only one is the real aggressor. The name of *Lactobacillus odontolyticus*, types 1, 2 and 3, has been given to these germs. The mouth condition under which these troublesome bacteria operate does not need to be acid for these germs can concentrate the acid they produce in restricted spots on the teeth and cause the destruction.

"Modern civilized diet is, no doubt, a contributing factor of dental decay as it leaves much starch and sugar in the mouth capable of being fermented by the bacteria," said Dr. Rodriguez. "Modern diet lacks savory and acid constituents sufficient to stimulate a copious flow of saliva of the proper character. But the bacteria are the real cause and their growth is favored by the mouth conditions of modern civilized peoples.

"Tooth decay or dental caries is one of the most common of human diseases which has so far evaded inquiry as to its specific exciting cause. Since the time of Koch, it has been assumed that tooth decay was caused in some way by bacteria. Dr. W. D. Miller, an American who became a professor in the University of Berlin, worked with Koch and by a series of brilliant researches firmly established what is known as the chemico-bacterial theory of the cause of decay. In short, this hypothesis is that bacteria, of which there are an immense number of species in the mouth, through their life processes ferment acids on the tooth surfaces from starch and sugar food left in the mouth. The acid decalcifies or dissolves the hard ingredients of the teeth, opening passageways into the deeper parts of the teeth through which the bacteria pass and finally cause a dissolution of the hard parts of the teeth. Miller demonstrated bacteria in the fine channels in the dental tissues. Miller was unable, however, to isolate the specific bacterium which was the real aggressor and initial destroyer of the dental tissue. Since Miller's work, 1880 to 1890, it has been assumed that many species of mouth

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111TH SESSION

Reorganized on a full-time basis

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ALL THE GENERAL FACILITIES OF THE UNIVERSITY ARE AVAILABLE TO MEDICAL STUDENTS

As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

bacteria which were capable of elaborating acid caused decay."

Dr. Rodriguez said that further work in identification of the newly discovered bacteria will be carried on and that great possibilities for caries control exist when several suggestive factors that this investigation has developed are worked out.

Concurrently with the work at the Army Medical School on the bacteriology of dental caries, similar work by a group of British scientists was carried on in the Bland-Sutton Institute of Pathology in London. This work has been reported by Dr. James McIntosh and co-workers in the British press. Identical results were obtained in some respects and similar conclusions arrived at.

LIGNITE FUEL

Science Service

LIGNITE char for household or industrial fuel can be made at much lower cost than heretofore, according to results obtained by state and government workers. Engineers believe that this is welcome news, especially to those who live in the Dakotas, Montana, Texas or the other states underlaid by extensive lignite deposits.

Previous workers have generally tried to make gas, tar and other by-products as well as the solid coke or charcoal residue. But W. W. Odell, of the U. S. Bureau of Mines, now reports on tests made in cooperation with the University of North Dakota in an effort simply to make this solid fuel at low cost, without the extra expenses involved in recovery of gas and tar. The results he gives were obtained with a lignite carbonizer which is cheap to build and to operate. With such apparatus Odell makes the char at approximately $1.25 per ton cheaper than was possible with earlier forms of apparatus.

The raw lignite is twenty-five to thirty per cent. water and about five to fifteen per cent. of ash, so that it has a heating value of only 6,000 to 7,500 British thermal units per pound, or about half that of high-grade coal. But when coked in the new type furnaces it gives forty to forty-five per cent. of its weight in a char of 10,000 heat units per pound that is suitable either for making fuel briquets or for use direct as a fuel.

Mr. Odell states that the char itself is "a splendid free-burning fuel," but that it has to be burned in stoves or heaters the grates of which will handle a fine fuel. The bureau engineers and chemists have built some special stoves and heaters which satisfactorily burn the fine material. However, they expect much more general use of the product in briquets.

The estimates are that a successful plant to make one hundred tons of briquets per day would cost $130,000. About three fourths of the investment would be for the briqueting machinery and its accessories and only one fourth for the carbonizing plant. Under these conditions the char or fine material would cost $4.85 per ton and briquets ready to market $8.17 per ton. These prices in lignite regions compare with anthracite quotations of $18 to $20 per ton.

THE PSYCHOLOGY OF STREET LIGHTS

Science Service

ORNAMENTAL street lights now used in many American cities waste two thirds of their illumination upward into space, cause eye injuries, and make motor traffic more dangerous, it was asserted by members of the local branch of the Psychological Corporation at a recent meeting in Washington. Participating in the discussion were Dr. Raymond Dodge, chairman of the division of psychology of the National Research Council, Dr. Shepherd I. Franz, director of laboratories of the Government Hospital of the Insane, and Colonel R. M. Yerkes, commanding officer of the division of psychology in the Office of the Surgeon General during the world war.

Methods were suggested by which at the same cost twice the present amount of light could be delivered to the sidewalk and roadway and traffic dangers decreased. Lighting for use rather than ornament was advocated.

Street light is useless unless it falls on terrestrial objects, it was pointed out. Light that radiates upward into space might make a pretty sight from Mars, if the inhabitants of that planet could see it, but it is useless for street illumination. Most of the light from the white street-lamp globes goes off into empty space or lights the fronts of buildings. Only about one third serves to illuminate the sidewalk and streets.

At the same cost, it was declared, illumination of streets could be made twice as effective. Although full salvage of the lost light would be impossible without disfiguring or abandoning the present pretty white globes, something would be accomplished by placing a horizontal reflector on the bulbs. It would be still better, it was emphasized, to replace the globes by scientifically designed reflectors which would form a hood over the lamp and concentrate the light downward where it is of use.

Instead of seeing a lot of pretty lamps as one looked down the street, cats, dogs and people, automobiles and the road, would stand out strongly. The difference would be much the same as the difference in the appearance to a driver of the road when illuminated by his own head lights

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GEO. M. GRAY,
Curator, Woods Hole, Mass.

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

AMERICAN SCHOOL IN FRANCE OF PREHISTORIC STUDIES

Archaeological Institute of America

American Anthropological Association

Three scholarships for the year 1923-1924 are available.

Applicants should have some knowledge of prehistoric archaeology, not necessarily in the European field, and some acquaintance with French; a long course of preparation is not absolutely necessary.

The work of the School begins July first of each year, and continues for one year.

The time is divided between excavations, excursions and study in museums. This is supplemented by attendance at lectures given by French scholars and by the American Director.

Those who consider entering the school, whether or not applicants for scholarships. and whether or not intending to pass the entire year in the School, should address the chairman as soon as possible.

GEORGE GRANT MACCURDY,
Chairman
Yale University Museum
New Haven, Connecticut

WANTED: A PSYCHOLOGIST.—A diagnostic clinic for neuro-psychiatry and psychology is being organized in Los Angeles. A psychologist is wanted to assume charge of the work of intelligence testing, measurements of special aptitudes, and other applications of psychology for which a demand may appear or may be stimulated. Prerequisites are: Ph.D. in psychology, good recommendations, and an interest and experience in applied psychology. This is not a salaried position, but is believed to be a good opportunity for undertaking private practice of psychology in collaboration with a group of physicians and under generally favorable conditions. Those interested will kindly correspond immediately with Dr. Aaron J. Rosanoff, 518 Marsh-Strong Building, Los Angeles, California.

TEACHERS WANTED

College positions with desirable salaries offered teachers for all departments of the Sciences. Special terms. The Interstate Teachers' Agency, Macheca Building, New Orleans, La.

The Microscope

By SIMON H. GAGE of Cornell University

13th Edition, Published December, 1920

In this edition, special emphasis is put upon the Dark-Field Microscope. POSTPAID $3.00.

COMSTOCK PUBLISHING CO., Ithaca, N. Y.

as compared with the way it looks under the illumination of an oncoming automobile.

The glare of the bright spots of light, such as that made by the white globe lamps, decreases the visibility of near-by objects. This is exemplified in the familiar and sometimes disastrous effect of oncoming automobile headlights.

Lights, provided with reflectors to direct the illumination toward the earth and shield the eyes of motorists and pedestrians from glare, should be numerous enough to prevent deep shadows and avoid the flicker caused by sharp alternations between light and dark. Nature has provided the eye with a compensating mechanism by which it may adapt itself to partial darkness and still see very well. But this mechanism acts slowly and rapid alternations of dark and light is trying on the eyes and disturbs vision whether in the movies or on the street.

"Street lighting must be based on common sense, but no good common sense ignores scientific facts. Modern street illumination makes a pretty effect, but it is inefficient in these days of congested fast traffic and high taxes. It would pay any city to have its lighting arrangements planned by a specialist, an illuminating engineer in consultation with artists and the local lighting companies."

NEW USES FOR COPPER BY-PRODUCTS

Science Service

COPPER refineries in this country are in a position to produce much more tellurium and selenium if there is a demand for these unfamiliar elements, Dr. Victor Lenher, professor of chemistry of the University of Wisconsin, told the American Institute of Mining and Metallurgical Engineers on February 21. He pointed out many possible uses to which these substances could be put.

Selenium is chemically similar to sulfur and experiments already made indicate that it might be used instead of sulfur in dyestuffs and in the vulcanization of rubber. The principal uses of selenium, at present, are in the manufacture of ruby glass and as a decolorizer of white glass. Crystalline selenium is an electrical insulator in the dark, but when exposed to light it becomes a conductor, the conductivity being proportional to the intensity of light. This property has led to its use in many ingenious mechanical devices, including machines for sending pictures by radio, self-lighting buoys as sea-coast safeguards, and an apparatus to enable blind people to read ordinary type by ear.

Tellurium, now used as a crystal detector in wireless receivers, as a blue, brown and red coloring agent for glass and porcelain, and for toning photographic prints, could probably, he suggested, be employed in electrolytic plating. One of the compounds of tellurium will prevent knocking when added in small amount to heavy gasoline, but he said that it is not abundant or cheap enough for general use in automobiles and a specially designed engine is required.

ITEMS

Science Service

SCORES of radio stations have been set up in the Belgian Congo where in the past savage drum signals alone were heard.

GASES pass through solid, heat-resisting quartz glass when heated to 300 to 900 degrees Centigrade faster than they could flow through small holes in the glass, J. B. Johnson and R. C. Burt, of the engineering department of the Western Electric Company, have determined. The transfusion begins at the temperature at which structural changes are known to occur in crystalline silica and suggests that the passage of gas may accompany a change in the structure of the non-crystalline material. The gases used were nitrogen, hydrogen and the rare gas, argon.

ANDRODEDOTOXIN, the poisonous principle contained in the leaves of the rhododendron, has been studied pharmacologically by Dr. S. W. Hardikar, of the University of Edinburgh. This substance when administered in large doses causes death by paralysis of the heart muscle, while in smaller amounts its fatal action is due to the failure of breathing through its action on the nerves to the muscles of the chest which are concerned in the act of breathing. A few years ago it was noticed that sheep in the neighborhood of Edinburgh showed toxic symptoms after eating rhododendron leaves, with fatal results in some cases. Interest in such observations led Dr. Hardiker to study the poisonous substance which these leaves contained.

INTRODUCTION of a new alloy used for one of the electrodes in the electrolytic refining of copper has cut the cost of copper production at Chuquicamata, Chile, to only 6.4 cents per pound, according to the annual report of the Anaconda Copper Mining Company. The new alloy consisting essentially of copper and silicon, developed by C. G. Fink, is used for the anode during copper recovery from the electrolyte and reduces current losses and contamination of the product experienced when ferrosilicon and lead electrodes are used. Figures of the Chile Copper Company show that the cost per pound of copper exclusive of interest depreciation and depletion dropped from 10.8 cents in 1921 to an average of 6.4 cents in 1922. In 1915 the figure was 16.34 cents.

SCIENCE NEWS

THE PRODUCTION OF RUBBER

Science Service

SCIENTISTS see a challenge to American ingenuity in conditions revealed by a meeting at Washington of leading raw rubber consumers to protest against restrictions placed by the British on rubber exports from the Malay Straits. America, which uses about three quarters of the world's rubber, should establish sources independent of the British monopoly. British planters now virtually control ninety per cent. of the world's raw rubber.

In the Philippines there are a million acres of potential rubber plantation land on which Para rubber could be raised on the same system used by the British and Dutch in the East Indies. Philippine land laws which restrict holdings to no more than 2,500 acres stand in the way, and American manufacturers have been afraid to start plantations in the Philippines because of the uncertainty of their political future. The British and Dutch have built up the plantation rubber industry with cheap and plentiful coolie labor. In South America, the original home of the raw rubber trade, the supply comes from the rubber trees which grow wild, and there, too, the relative scarcity and high price of labor prevents the cultivation of these trees in competition with the coolie labor used by the Dutch and British in the far east.

In Central America, the rubber is obtained from a different tree, Castilla, but this tree can not be tapped repeatedly as can the South American tree, Hevea, which the English and Dutch have brought under cultivation in the far east.

Agricultural experts here, however, think that there is a possibility of raising rubber from this Central American tree under the typical American system of extensive farming with little labor, in much the same manner that the turpentine and rosin industry is carried on in our southern states. They say that the trees could be planted, left to themselves and then tapped to destruction, or the trees cut down and all the rubber milk extracted and the wood then used for paper or other purposes. The land is available and experiments should be carried on to determine whether such a system offers a solution to rubber raising in this hemisphere in competition with the cheap coolie labor of Asia.

Not only may this be done, but great supplies of low grade rubber, although lacking the elastic properties of the material obtained from the South and Central American trees, can be obtained from a number of plants of this country and Mexico. This rubber, mixed with the more elastic product, forms a product of greater strength than the pure South American or Central American rubber.

Guayule, a Mexican plant, has been utilized to furnish this class of rubber and scientists of the Carnegie Institution of Washington, who have been experimenting with rubber-producing plants in our southwest since the world war, called attention to the necessity of our having a home-grown supply. They have also found that the desert milkweed offers possibilities of development into a practical source. The stems of this milkweed, which grows in scattered clumps in the southwest, carry from two to six and one half per cent. of rubber. This is too low a yield to justify the growing of the plant on a commercial scale, but the nature of the plant indicates that this percentage can be materially increased by well-known methods of breeding and selection.

The fiber of this desert milkweed makes good paper. The paper yield is about thirty per cent. of the total weight of the dry plant. By using both the rubber and the fiber, they point out, it may become an economically important plant, not only helping to furnish a home-grown rubber supply, but also putting to use vast extents of land now lying idle in our western states.

Brazil up to 1910 had a monopoly on the world's raw rubber, obtained from the wild trees, and maintained by restrictions against the export of the seed of rubber plants. In 1876, however, an English scientist smuggled a shipload of seed to England. From botanical gardens there, seeds were sent to Ceylon and the foundation of the plantation rubber industry of the far east was laid. Rubber trees were scientifically bred and trained, like cows, to give greater quantities of milk.

It was the growth of the automobile industry in America, however, which created the tremendous demand that enabled this infant industry to outstrip the wild rubber of South America, and made the center of the world's rubber industry bounce to the other side of the globe. But the supply grew faster than the demand, and in order to keep up profits, the British imposed an export tax last November to limit production. The demand is still growing, however, and threatens to again overtake the supply, while the British restrictive measure, it is estimated, will at present cost add $200,000,000 to the bills of automobile owners and other rubber consumers. Further advances may send prices still higher.

THE MANUFACTURE OF NITRATES

Science Service

FRANCE will eventually be independent of Germany for nitrates in time of peace, and will be self-sustained in this respect in war time if the bill now before the Chamber of Deputies authorizing the convention with the Badische Anilin und Soda Fabrik becomes a law. The convention gives to the French possession of the secret of the Haber process used by the great German chemical company for the production of ammonia from the nitrogen of the air.

It is admitted that the German interests gave their approval only under pressure from the French, although it is denied that any threats to actually steal the secret by force were made. According to the convention, German engineers will help install at the French plant to be constructed at Toulouse the process which was in use at the great works at Oppau which were recently blown up by an explosion. French engineers have already been able to inspect the German factories where the method is used.

The estimated cost of the projected plant at Toulouse is approximately $5,000,000. It will supply 36,000 tons of nitrates a year which, although hardly more than a third of the total French consumption, will make the country much more nearly self-sustaining than it has been hitherto. With the secret in possession of the French the process may be developed in other localities than Toulouse.

The secret process concerns just what substance was used as a "catalyser" to effect the chemical union of the free nitrogen from the air with the hydrogen which is mixed with it under pressure. A "catalyser" is in chemical industry what a man who is "the life of the party" is in a social gathering. He may not do much himself but he brings interesting folks together and starts something. No one knows just how a "catalyser" works, but when two unfriendly substances are brought together in its presence under the right conditions it causes them to unite. The Badische company had discovered such a go-between for nitrogen and hydrogen which enabled them to bring them into chemical combination more cheaply than by most other methods.

NEW STARS

Science Service

REPORTED observations from Paris of an extraordinary increase in brightness of the star Beta Ceti are not confirmed by the astronomers at the Mt. Wilson Observatory, which is the best equipped institution in the world for spectroscopic study.

According to Dr. W. S. Adams, acting director, there has been no certain increase in brightness and definitely none whatever in the spectrum of the star. The latter statement is of especial importance as sudden increases in brightness of stars are accompanied with marked changes in the spectrum.

Dr. Adams thinks the star may have been confused with one of its near neighbors in the constellation of the Whale, Mira Ceti. This is a variable star and was known to the ancients as the "wonder star." It fluctuates in brightness over a period of 331 days and is now at its brightest, being somewhat fainter than the Pole Star. There is no evidence at the Mt. Wilson Observatory for such an outburst of brilliancy on the part of Beta Ceti as was heralded all over the world on the authority of Camille Flammarion, the French astronomical writer. Even if the star had increased in brightness enough to raise it from the second to the first magnitude, it would not imply, as the Paris despatches stated, that its heat had been raised ten or fifteen times.

Variable stars and new stars, that is, stars which increase suddenly in brightness, are familiar to all students of astronomy. Several "novæ," as these "new" stars are termed, have been observed in modern times. The most recent was the one known as Nova Aquilæ III, which became a notable object in the skies during the summer of 1918.

Known for centuries as a quiet, unobtrusive little star, visible only through telescopes of fair power, this star suddenly went on a rampage and in the space of a day blazed up to a brightness only exceeded among the stars by that of Sirius, the brightest of all and the most striking object in the midwinter southern sky. After a few days of this brilliant performance the star lost its pep and by October had again faded from the sight of the unaided eye.

Another notable example was Alpha Persei, which about twenty years ago suddenly increased from the brightness of a dim star to one of the first magnitude and like the others of its kind slowly faded again into insignificance. A star in the constellation of the Swan which had been so faint as to be barely visible through a high power telescope also jumped into the spotlight by a similar performance in 1920, although it never achieved more than the second magnitude of brightness.

The cause of these "novæ" is a matter of dispute among astronomers, but the best opinion is that because of their lack of permanence they

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

are due to effects merely on the surface of the orb. There is an immense amount of heat thrown off, and the diameter of the star becomes enormously increased due to the uprushing at inconceivable speed of vast masses of incandescent gas.

INFLUENZA AND THE DEATH RATE

Science Service

THE current epidemic of influenza and pneumonia has been largely responsible for an increase of nine per cent. in the death rate for January over that of a year ago, according to the monthly statement of the Metropolitan Life Insurance Company. The rate was 10.5 per 1,000, which is higher than for any January since 1919, when the country was in the later phases of the great epidemic of influenza. Deaths from automobile accidents are the highest of record for January.

The relatively high mortality of the month was due largely to the increased death toll of influenza and pneumonia, together with higher rates for important organic diseases such as heart disease, cerebral hemorrhage and Bright's disease. The present influenza outbreak, like prior ones, has been indirectly responsible for higher mortality from these organic diseases.

Unusual prevalence of influenza was first observed in several southern states—more particularly, the Carolinas, Georgia and Tennessee. It now appears to have passed its peak in these states, but is developing not only in a number of adjacent sections (Maryland, District of Columbia, Kentucky and Louisiana) but in other parts of the country, for example, Maine, Connecticut, New York, New Jersey, Ohio, Illinois, Michigan, Wisconsin, Nebraska, Kansas and Texas—and, to a lesser extent, in Wyoming, New Mexico, Oregon and California. Pronounced increases in the number of cases and deaths have been recorded in cities located near the southern border like Baltimore, Washington and Cincinnati. Chicago, Columbus and Detroit in the middle west are reporting many cases. In New York City, the influenza and pneumonia mortality rate has likewise risen.

Very decided increases as compared with January, 1922, have also been recorded in the death rates for measles, whooping cough, tuberculosis, accidents—and more particularly, automobile accidents. The month's death rate for the last was 10.8 per 100,000, the report states.

"This marks, not only a pronounced rise over last year's January rate, which was 9.0; but stands as the highest January figure ever recorded for this type of accident. It is discouraging indeed to announce that, bad as the automobile accident situation has been in recent years, present indications are that it is growing worse. The automobile fatality situation is the foremost public safety problem of the present day."

SUCCESS OF FISHERIES DEPENDENT ON BALANCE OF LIFE

American Museum of Natural History

COMMENTING upon the agitation in various western papers regarding the destruction of salmon by sea-lions, Mr. John T. Nichols, of the department of ichthyology of the American Museum of Natural History, says that the balance of life in the ocean is a very intricate and delicate one. On this balance depends the abundance of any particular kind of fish. As the success of any fishery is in turn directly dependent on the abundance of the fish which it involves, the economic importance of knowing about the balance of ocean life is at once apparent. Unfortunately, up to the present, our knowledge of ocean life is still meager in comparison to that which is still to be found out and concerning which we are obliged to rely on hypothesis. It is of the greatest importance that this fact should be realized by those interested in the conservation of our fisheries, to the end that ocean research shall have their support.

Failure to realize that this problem exists is one of the causes for bringing forward perfectly ridiculous explanations of the depletion of fisheries. The claim that sea-lions are destroying the salmon fisheries of the Pacific Coast is a good example. As a mattter of fact, where salmon are the most abundant and available fishes in the sea, it is true that sea-lions eat them in large numbers and can swallow the large ones whole. Sea-lions have been taken at the mouth of the Columbia River literally filled with salmon, except for the one or two big cobble-stones which are ordinarily to be found in a sea-lion's insides, and which he is probably tempted to swallow, although he does not know it, because they will churn around and help to grind up the fishy content of his stomach. Nevertheless, it should be sufficient to dispose of the sea-lions as the active agent in the reduction of the salmon supply to call attention to the fact that they were unquestionably in the field and as destructive, in the days of the redmen, when these same fishes were everywhere present on that coast in enormous numbers.

History tells us that the Atlantic salmon entered rivers abundantly as far south and west as the Hudson in the early days. Although a few are still taken to the eastward in the vicinity of Buzzard's Bay, a few small individuals perhaps being found there every year, salmon have become practically non-existant south of the long sandy

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arm of Cape Cod. Northward from that point, where seals are comparatively numerous, they still exist in varying numbers. The disappearance of the Atlantic salmon from our waters is mentioned here because it is a case that can be explained very easily. From Rhode Island to New Jersey there are no longer any rivers sufficiently free and unpolluted to be suitable for it to enter and spawn. This pollution, which has wiped out the salmon from the area, has doubtless been of indirect harm to sea fisheries also. The alewife, a kind of herring, formerly entered all its small streams to spawn in spring in vast numbers, and these alewives, on returning to the sea, were a rich food supply which attracted such fish as the cod. Alewives are no longer able to use many of their ancestral streams, and their legion has dwindled to insignificance. This alone would account for a lesser abundance of cod and haddock.

The examples cited give little idea of the intricacies of the problems which remain to be worked out. Human interference, and especially commercial fishing, doubtless menace the fish supply all along the line, but so great is the productivity of the ocean that, on the other hand, a still greater development of commercial fishing is probably possible without "killing the goose that laid the golden egg," provided it is regulated with due consideration for the balance of life which exists in the sea, and checked where it presses on sensitive points. It is as fallacious to shout "over-fishing" whenever a given fish decreases in numbers as it is to shout "sea-lions" when the catch of Pacific salmon falls short of the expected.

ITEMS

Science Service

THE reported finding in Patagonia of a fossil skull alleged to be that of an ape-man who lived there about a million years ago is scouted by leading anthropologists as highly improbable. The consensus of opinion based on scientific evidence indicates that the Americas were not inhabited by human beings until comparatively recent times and the first men here were close relatives to Indians now living. No early men, corresponding to the primitive cave-man types of western Europe, have ever been found on either of the two American continents. The first discoverers of America reached this continent at a much later date and represent a much more highly advanced human type than these cave-dwellers. Reports of findings of prehistoric remains alleged to be of great antiquity have been frequent, but have all proved either much younger than claimed or not the remains of man at all but merely peculiar rock formations roughly resembling the shapes of heads and other human remains.

DR. ALEŠ HRDLIČKA, anthropologist of the Smithsonian Institution, gallantly has come to the rescue of the prehistoric lady whose skull has just been reported found in the English Channel island of Jersey. This female is probably much younger than cable dispatches from England would indicate. It is not surprising that a cave-woman skull should have been found in Jersey, said Dr. Hrdlička, who is well acquainted with the island and its remains of ancient man. About fifteen years ago the teeth of a primitive man belonging to the Neanderthal period were found and prehistoric implements and other remains are plentiful there. The age of such remains can, however, be only roughly determined from the sediment in which they are found. He thinks it unlikely that the female skull found near the Jersey village of St. Owen is anywhere near so old as the Java ape-man remains known as *Pithecanthropus erectus*, or even the Piltdown jaw found in England. Although man in western Europe dates from very early times, going back from 50,000 to 150,000 years, none of the low-browed skulls of early man is nearly so close an approach to the apes as the Java skull which has been estimated to be 500,000 years old.

A SCIENTIFIC plan for the future development of New York City, more thorough and comprehensive than anything of the kind ever before attempted, and including all the territory within fifty miles of Battery Park, is being begun by a committee of experts appointed for that purpose by the Russell Sage Foundation. The committee is known as the "Committee on the Plan of New York and its Environs." All suburban territory will be divided into six sections and one expert will make a particular study of its problems and of their relation to the whole plan. The survey will include consideration of every phase of city life with special reference to housing, transportation, zoning and recreation. The ultimate object is the decentralization of New York to the greatest practicable extent, possibly through the creation of self-contained suburbs or "satellite towns" whose inhabitants will find opportunities for work, education, religious observance and recreation without going to the center of the city. A preliminary report will be made on October 1.

THE chemical faculty of the University of Chicago is soon to broadcast chemical lectures by radio.

THE bones of an ape which had been confined in a Theban temple some 2,000 B.C. have furnished the first known example of rickets.

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SCIENCE NEWS

DRIFTING CONTINENTS

Science Service

THE stars do not favor the theory that North and South America were formerly in contact with Europe and Africa and have gradually drifted apart during the last few million years, leaving a rift behind that has been named the Atlantic Ocean, Dr. Harlow Shapley, director of the Harvard College Observatory, told the American Philosophical Society at Philadelphia on March 2. Scientists have been interested during the past year in this hypothesis insistently advocated by Professor Alfred Wegener, of Hamburg.

"The known facts and the most probable conclusions of astronomy are not favorable to the new theory," said Dr. Shapley. "Observations on the variation in longitude and latitude do not make such a theory necessary. The attraction of the moon does not appear sufficient to account for the drifting continents with the resulting birth of the great mountain ranges of North and South America. The astronomical theory of the origin of the moon does not make it necessary to believe that at one time all the land on the surface of the parent earth was combined in a super-continent."

The theory accounts for a great many facts concerning the distribution of animal life at the present time, and as well for the distribution and arrangement of geological formations, Dr. Shapley admitted. But many other facts of biology and geology are not satisfactorily interpreted by the theory, or at least they do not demand such a revolutionary hypothesis for their explanation.

"In its present form the theory holds that during all those long geological periods when fishes, insects and reptiles were the predominant animal forms, South America fitted into the indentation on the west coast of Africa. At the same time, the Atlantic shoreline of Canada and the United States closely fitted the western margin of Europe. Some fifty or more million years ago, the great rift is believed to have formed, and the Americas began their western drifting, crumpling up the bed of the eastern part of the Pacific Ocean and thus forming the Andes and mountains of western North America, which date from about that time.

"Astronomical records show that during the last forty years Greenland may have drifted west by about three-quarters of a mile. The early observations are not very definite, however; and there is no positive evidence from accurate modern observations that the American continent is now drifting westward."

HAFNIUM

Science Service

THE Danish scientists, Coster and Hevesy, have announced that there is more hafnium, the new element they discovered, than gold in the world, yet European scientific discussion still centers around the new chemical element Number 72, according to information reaching here.

These Danish scientists have examined the material sent them by Dr. Alexander Scott, English chemist, who believed that an unidentified oxide isolated by him several years ago contained the new element. The Danes found that the Englishman's sample does not have in it even a trace of the new element they identified by X-ray spectroscopy.

Dr. Scott now plans to investigate his unknown material in the hope of discovering some other new element, probably similar to titanium.

In the meantime, Drs. G. Urbain and A. Dauvillier, of Paris, who about six months ago announced that they had discovered a rare earth that seemed to be element Number 72, and who named it "celtium," are urging the correctness of their claims and the possibility that the Danish scientists are wrong.

But the Danes feel sure that they have discovered the right element to fit into the predicted chemical scheme of things, and, while they found no hafnium in Dr. Scott's samples, they report that hafnium appears in great abundance in zirconium minerals, and they estimate the hafnium content of the earth's crust to be more than one part in one hundred thousand. If this is true, there is more of the new element in the world than of such well-known elements as gold, platinum, silver and selenium. They also aanounced that Professor V. Goldschmidt in Christiania has discovered a mineral in which hafnium is the main mineral constituent.

While industrial use of the new element is probably some distance in the future, it has been suggested from its chemical relations that hafnium may prove useful in the manufacture of gas mantles, incandescent filaments, alloys, refractories, glass and other materials in which hafnium's chemical sister, zirconium, is now used.

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AUTO ANTI-FREEZING MIXTURES

Science Service

Glucose is more dangerous than wood alcohol—as an anti-freeze mixture for cooling automobile engines. The U. S. Bureau of Standards has investigated the recently reported value of the sweet compound when used to prevent radiator freeze-ups and found that the autoist runs a big risk in using glucose. Solutions of wood or denatured alcohol seem most desirable for cold weather protection.

Any strength of glucose solution which can be made will freeze, and freeze solid, at a temperature but very few degrees below the freezing point of water. Although it will probably prevent the bursting of the radiator, it will not protect against the other serious effects resulting from a freeze.

It has been found that in glucose solutions the process of freezing is gradual, a slush forming which thickens continually as heat is abstracted, becoming a hard whitish mass streaked with veins, so that a tube of the frozen material looks very much like a stick of lemon candy. Evidence is strong that under radiator conditions the slush stage may be relied upon to continue beyond the period of marked volume changes incident to freezing, whence there will be no confined pressures and so no danger from bursting. But bursting is not the only damage inflicted upon an automobile engine cooling system by a freeze-up. Total stoppage of the water circulation may have serious effects upon the pump if there be one in the water line, and the engine is likely to overheat severely shortly after starting, with the consequent formation of steam at considerable pressure blowing out gaskets and connections. The question which confronts an automobilist in regard to the use of glucose in his radiator is therefore whether or not the exposure to cold weather will be long enough to freeze his solution to a thick enough slush to threaten dangers from the stoppage of circulation.

For all practical purposes the freezing point of any strength solution of glucose which could be employed would lie between 25 degrees Fahrenheit and 30 degrees Fahrenheit. Furthermore, it would be frozen absolutely hard and solid at such a temperature, given time enough to extract the latent heat which must be abstracted to freeze a substance. These facts are reconciled with the successful use of glucose solutions in automobile radiators exposed to very cold weather, often below zero Fahrenheit, because of the time factor involved.

THE NICARAGUAN CANAL ROUTE

Geographic News Bulletin

WHETHER a Nicaraguan canal will be built is a question which only the future can answer; but it has been so continuously discussed and its possible site so thoroughly surveyed that the term "Nicaraguan canal route" is easily described. Interest in it has been reawakened by the recent signing of a protocol between the United States and Costa Rica, relating to the proposed canal.

The Panama Canal, if one leaves its locks and small artificial lake out of consideration, may be considered the American Suez; for it is relatively short and direct. The Nicaragua route—again ignoring locks—must be compared with the Turkish straits; it is relatively long, and has in its course a great natural inland sea from which narrow ship-ways are projected.

A Nicaraguan canal would be less a man-made affair than the Panama Canal, where at every turn nature had to be thwarted and subdued by engineers. There ships now move every foot of the interocean way through great ditches that were dug, locks that were built, or a lake that was created by men. The Chagres River was turned aside to make a lake and even its bed was discarded. If a Nicaraguan canal were built according to existing plans, it would entail much excavation and lock building, but work that nature has already done would be utilized to a marked degree.

From the Atlantic end a canal would have to be excavated, largely through lowlands, for some fifty miles, for the lower reaches of the San Juan River are clogged with sand brought down from the uplands of Costa Rica. Locks would then raise the waterway to the 106-foot level of the lake. Ships would be transferred into the San Juan River, dammed at this point, and would move up its slack water for approximately forty-five miles to Lake Nicaragua. This lake is a really large body of water—one of America's "Great Lakes"—though far from its peers. It is one hundred miles long and forty-five wide at the broadest point, and is the most extensive body of fresh water in North America south of Lake Michigan. For seventy miles ships would use the waters of Lake Nicaragua. Then would come the descent to the Pacific through a canal and locks covering the dozen miles or more of narrow isthmus that divides the lake from the ocean.

The river and lake portion of the route above the dam, however, would not all be in readiness for use without the expenditure of labor. Of

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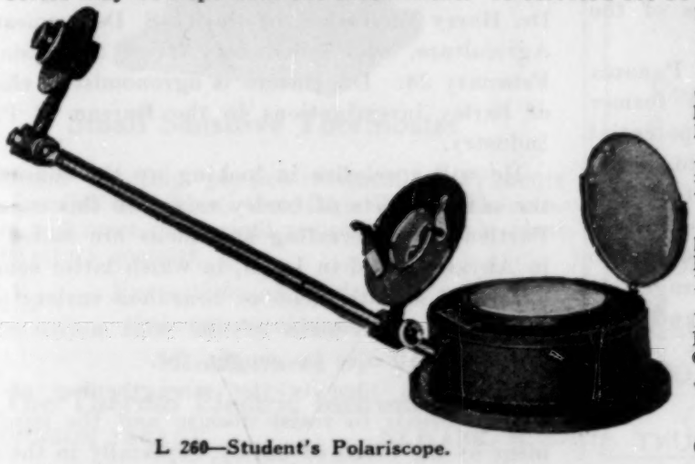

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the forty-five miles of river, twenty-eight would require improvement, while a channel would have to be dredged through a score of miles of the lake near the river outlet where silt has accumulated.

The Pacific side of the canal would present relatively few difficulties. The narrow divide at the point crossed by the canal route rises only forty-four feet above the lake level. Altogether the canal route, from deep water to deep water, would be about one hundred and eighty miles long. The passage of ships would require more than twenty-four hours as against twelve or less at Panama. Such a canal could be reached, on the other hand, more quickly from ports of the United States.

One other contrast exists between the Panama Canal and the Nicaraguan route. The former traverses a country of relatively limited potential wealth. A canal through Nicaragua would doubtless be a strong factor in the development of that country, opening up its vast forests of both hard and soft woods and tapping its coffee and cacao plantations and its mines. Lake Nicaragua is already an important inland waterway, and near its banks are some of the chief cities of the republic.

PLANTS AND ANIMALS ON MOUNT EVEREST

Science Service

ALTHOUGH the 1922 British Expedition to Mount Everest failed in its principal aim, which was to reach the top of the highest mountain in the world, it did succeed in finding out a number of things of much interest to scientific men. These things are now being made known in various scientific journals.

Certain brave little plants, such as edelweiss, were found blossoming at a height of nearly twenty thousand feet. Wild animals and birds, such as mountain sheep, ravens and rock doves, unacquainted with human beings, showed no fear of them at all, readily eating from the climbers' hands. These wild sheep, ravens and doves, together with wolves, foxes, rabbits, rats, mice and condors, with a few other birds, were found at an altitude as high as twenty thousand feet and occasionally even a thousand or more feet higher. Condors were observed flying high above the mountain's north summit, twenty-four thousand feet above sea level, where the atmosphere was only one third as dense as at sea-level.

Some naturalists have proposed the theory that life on the earth must have begun first on mountain summits, for these summits might be considered as the first parts of the earth to be cool enough for the existence of living things. Geologists point out, however, that many of our highest mountains were formed since those earlier geological epochs in the rocks of which plant and animal foods have been found.

EXPLORATION FOR CEREALS

Science Service

A VISIT to the old-fashioned and primitive relatives in the old countries of the cultivated and Americanized cereals with the purpose of bringing some of them back to mingle their vigor with the native stock, is one of the main objects of Dr. Harry V. Harlan, of the U. S. Department of Agriculture, who sailed for Africa and Asia on February 28. Dr. Harlan is agronomist in charge of barley investigations in the Bureau of Plant Industry.

He will specialize in looking up the cousins of the various sorts of barley raised in this country. Particularly interesting specimens are looked for in Abyssinia and in India, in which latter country a sort of smooth-faced or beardless variety is to be found. Specimens of the wild native wheat and oats will also be sought for.

The main idea is the strengthening of the native cereals to resist disease and the improvement of the breed of barley, especially in the arid regions of the Rocky Mountain region. In Abyssinia and in some of the high valleys of northern India, the cultivation of cereals has been going on for thousands of years, and the theory is that the species of grain raised there are particularly resistant to disease since the non-resistant sorts must have died off long ago. Specimens of these tough varieties will be brought back to be Americanized as their distant cousins were many years ago. While inferior in yield to the American stock they are expected to contribute their hardihood to a new variety which will combine the virtues of both parents.

An unwhiskered variety of barley which will give as good yields as the present sorts in cultivation here will also be sought, as well as Abyssinian barley which does particularly well in high altitudes and under arid conditions. Barley is not a popular crop with most American farmers because its detachable whiskers have an unpleasant way of getting next to the farmers' skin at threshing time, and a more smooth-faced variety would, it is thought, promote the cultivation of a valuable cereal.

Abyssinia, where Dr. Harlan expects to be during the barley harvest from October to January, has already contributed many interesting and unusual varieties of cereals to the world. It

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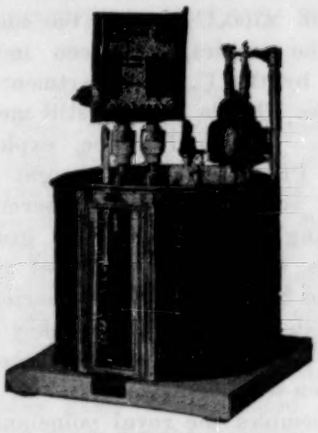

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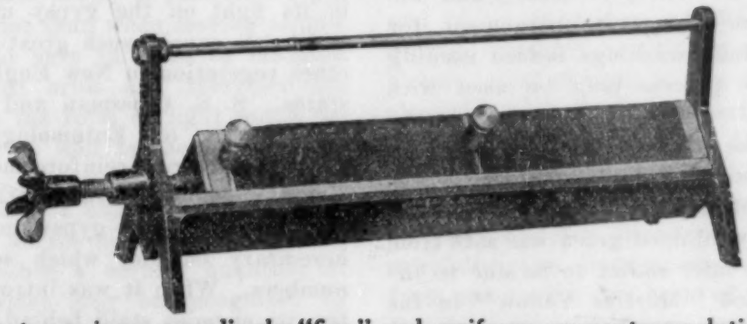

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Write for illustrated descriptive Bulletin No. 980

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has never been thoroughly explored by a trained expert in farm plants and Dr. Harlan's visit is expected to yield valuable results.

He will go first to northern Africa and from there to India, returning to Abyssinia, which he will enter from the Red Sea. Dr. Harlan has already conducted agricultural explorations in widely separated parts of the world, having been in the high plateau country of the Andes in South America for British interests and in Eastern Europe soon after the war on behalf of the relief work then planned in that section.

CONTROL OF THE CLOTHES MOTH

Science Service

THE clothes moth, which it is estimated destroys ten thousand tons of wool each year, may be absolutely controlled by the use of a new chemical called "Eulan F" which may be used in wool-finishing. The substance is harmless to human beings, but wool impregnated with it is not eaten by the larvæ of the moth except when starvation threatens and it is then speedily fatal. The chemical has been prepared at the dye works of Leverkusen, Germany, by Dr. Meckbach and his collaborators.

Although it is preferably applied to the woolen article during or after the finishing process in the factory it may be added subsequently to the completed goods by soaking them in a cold two per cent. solution, or it may be sprayed on. The goods are then rinsed with pure water, and the Eulan finish is then said to be permanent for three or four household washings before needing renewal. A similar process may be used with furs.

The success of the new preparation, which is claimed by its inventors to be complete, comes after many years of experiment. It was noted fifty years ago that wool dyed green was safe from moths, and this was later shown to be due to the use of pigment called "Martius Yellow" in the dye. This in turn was shown to cause an acid reaction in the intestines of the caterpillar and to be invariably fatal, the normal reaction of the intestines being alkaline.

It remained then to find a chemical which would have this effect on the caterpillar but be odorless and without effect on the color or finish of the goods. This, the inventors say, they have done, and tests extending over several years have demonstrated the efficacy of this remedy against this great enemy of the careful housewife, against which the sole protection had previously been a kind of gas attack through the use of strong-smelling chemicals.

ITEMS

Science Service

"FLOR DE MICO," one of the most beautiful trees of the tropics, has been imported from Guatemala by the U. S. Department of Agriculture to make Florida winters still more attractive to tourists. Wilson Popenoe, explorer for the Bureau of Plant Industry, brought home fifteen pounds of seed, from which several thousand sturdy young plants have been grown for distribution in the southern part of the everglade state and in our tropical dependencies. "Flor de mico," which is Spanish for monkey flower, drops its leaves and the entire tree becomes covered with crimson-scarlet blossoms at the end of winter. It resembles the royal poinciana.

DISTINCTIVELY oriental fruits, most of which are never seen in western markets, have been found to be well supplied with vitamin C, the preventative of scurvy, according to the results of researches by Hartley Embrey, of the Union Medical College, Peking, recently published in *The Philippine Journal of Science*. The fruits and vegetables which were found to have anti-scorbutic properties were the chico, papaya, pomelo, guava, lansones, both fruit and flower buds of the banana, coconut, pepino or cucumber, kangking leaves and camote leaves. The Chinese persimmon was also found effective.

CIVIL war in the insect world is to be further promoted by the U. S. Department of Agriculture in its fight on the gypsy moth, the insect pest which has caused such great damage to trees and other vegetation in New England and neighboring states. S. S. Crossman and Ray T. Webber, of the Bureau of Entomology, have sailed for Europe to recruit reinforcements for the army of insect enemies of the moth. In its ancestral European home the gypsy moth was afflicted with hereditary enemies which served to control its numbers. When it was introduced into this country, its enemies staid behind, with the result that the invader had things all its own way for years. Then the Department of Agriculture imported some of these enemies, which are parasites preying upon the eggs and caterpillars. These were shown to have an appreciable effect in keeping down the numbers of their enemies and now the department is sending abroad for reinforcements and also to investigate the possible existence of other similar enemies of the pest of the north-eastern states.

THE Mexican government has issued an order that operators take precautions to prevent the loss of natural gas.

SCIENCE NEWS

PROOF OF EINSTEIN'S THEORY FROM THE ATOM

Science Service

THE light from the interior of the atom, as well as the light from the distant stars, gives evidence in support of the Einstein theory of relativity, according to Professor A. Sommerfeld, of Munich. Following his series of lectures at the Bureau of Standards in Washington, he gave the results of his calculations of the orbits of the electrons in hydrogen and helium atoms and showed that the grouping of these lines in the spectra of these gases was in close conformity with the figures given by the Einstein formula.

According to the modern view of the internal structure of the atom there is a central nucleus of positive electricity around which revolve at high speed one or more negative electrons. These may move in circular or in elliptical orbits as do the planets around the sun. If the orbit is a circle the revolving electron moves at an even speed throughout its course. But if the orbit is an ellipse the electron must move faster when it is making the turn nearest to the central nucleus at the focus than when it is at the more distant end of the ellipse. This difference in speed would make no difference to the mass of the electron according to the old Newton theory, for this assumed that mass was unalterable. But according to the new Einstein theory a particle moving at high speed is heavier than when moving slower, so the electron would vary in mass in different parts of its elliptical orbit and therefore the energy it gave off in the form of light would depend upon the shape as well as the major diameter of the orbit.

There are only a limited number of such orbits that an electron can pursue and in slipping from one of these to another a certain quantum of light is given off which may be recognized by its position in the spectrum. The light given off from the incandescent gases, hydrogen and helium, as well as the X-ray spectrum of heavy metals like platinum, show that the corpuscles making up the atom obey Einstein's law instead of Newton's.

Astronomical evidence on the Einstein theory is expected whenever Professor W. W. Campbell, director of the Lick Observatory and president of the University of California, announces the results of his expedition to Australia last September to take photographs of the eclipse then visible. If the photographs show an outward displacement of the stars surrounding the darkened disk of the sun, it will prove that Einstein was right in predicting that a ray of star-light passing close to the sun would be drawn out of its course. For, according to Einstein, space about a heavy body like the sun is distorted so that light can not travel straight; a point that Professor Sommerfeld illustrated by putting his hand under the piano spread and puckering it up. A billiard ball, he said, would have difficulty in passing over such a hummock as light does in passing through a gravitational field. Space by itself does not exist but is produced by what is in it and the sort of space it is depends upon the amount and distribution and motion of the particles of matter.

SAMPLES OF HAFNIUM

Science Service

SAMPLES of minerals and concentrated preparations containing hafnium, the new chemical element discovered by Drs. G. Hevesy and D. Coster, of the Institute of Theoretical Physics, Copenhagen, are *en route* to this country for examination by chemists here. The samples have been dispatched by Dr. Hevesy to Dr. George F. Kunz, president of the New York Mineralogical Club, and are expected here shortly.

Hafnium is believed by Dr. Hevesy to be the hitherto missing or undiscovered element No. 72, and to be altogether a different substance from celtium, detected in 1911 by the French chemist, Urbain, who thought it was element No. 72, but classed it with the "rare earths."

In a letter to Dr. Kunz, Dr. Hevesy indicated that a new atomic weight value for zirconium, the metal with which hafnium was found, may be a by-product of the discovery. "Virtually all commercially pure preparations of zirconium contain from one to five per cent. of hafnium," said Dr. Hevesy. Since hafnium has an atomic weight greater than zirconium, it is believed that the present accepted value of zirconium is too high.

In explaining why hafnium fits into the vacant niche in the chemical table better than Urbain's celtium, Dr. Hevesy's letter explained that hafnium's chemical properties place it in the class of elements that include zirconium and thorium, and that "it has not been possible by means of highly concentrated hafnium preparations to reproduce the characteristic optical spectrum ascribed by Urbain to celtium, and which, together with an

investigation of the magnetic properties of his preparation, was the basis of the announcement of the discovery of this element.''

THE UNITED STATES PUBLIC HEALTH SERVICE AND PREVENTION OF DISEASE

United States Public Health Service

THE part played by the United States Public Health Service in the prevention of disease is not easy to evaluate, says Surgeon General H. S. Cumming. Some kinds of prevention work, such as that of barring foreign diseases out of the country, are now wholly in its hands; and for the results of such—specifically for keeping out typhus, plague and cholera while they were ravaging Europe—the service may fairly claim full credit. But most other kinds of prevention work in which it has been engaged have been carried on in greater or less part with the cooperation of state health officers.

Preventing the spread of disease from one state to another differs markedly from preventing the importation of disease from abroad; and except for the cooperation of the state health authorities, it could have been efficiently carried out only with great difficulty. The United States has authority over interstate traffic; but the several states have sole jurisdiction over traffic within their borders; and cooperation as to health regulations is essential to the adequate protection of passengers. Through such cooperation, formerly conflicting regulations have been harmonized and agreed upon by the Public Health Service and by twenty states in whole and by most of the other states in part; and this has made travel in the United States relatively safe from the standpoint of health. For instance, drinking water on trains and steamboats, which not so very long ago was obtained almost anywhere and which now and then carried typhoid fever germs, must now be taken from sources that have been examined and certified by the state authorities and the Public Health Service jointly.

Laboratory study of diseases is carried on chiefly by the service; but field work, by which data for the investigation are obtained and the results are often tested, can be carried on successfully only through the cooperation of the states.

In even more essentially cooperative work (rural hygiene, for example) it is difficult to say whether more credit for the great success of a particular work is due to the Public Health Service officer who directs, the state health officers who sustain him, or the citizens of the locality who toil so loyally to put the work across.

During the last twenty years the annual death rate in the United States has dropped for typhoid fever from 35.9 to 9.2 per hundred thousand of the population; for measles from 12.5 to 3.9; for scarlet fever from 10.2 to 2.8; for diphtheria from 43.3 to 14.7; for pneumonia from 180.5 to 123.6; and for all causes from 1,755 to 1,288.

This wonderful improvement in the health of the country is not due to the work of any one organization but to that of all of them. The Public Health Service, in common with many others in the state health services and in private life, has done its part in working out the methods by which this advance has been attained. The service, however, has, perhaps, been a little better able to render help because of its position as a central agency which collected information from everywhere; which trained its officers by sending them (with the cooperation of the state health authorities) to the battle front whenever an epidemic appeared in any state; and which sifted this and all other information that it obtained, digested it, and finally disseminated it so widely by formal printed reports, by newspaper and magazine articles and by radio broadcasts that it could not fail to come to the attention of a great number of workers who could not otherwise have learned of it, some of whom, failing to learn, might have been unable to carry to completion some task that would have fitted into the walls or might even have capped a pinnacle in the great health structure that the workers of to-day are building for the benefit of generations yet to come.

THE GIPSY MOTH THREAT

The New York State College of Forestry

CONFRONTED with the history of forest destruction by the gipsy moth, which in New England is immense in spite of the fact that twenty million dollars have been expended in attempting to control it, the authorities in New York have good reason to be alarmed. Especially is such alarm well founded because year after year the great hoards of gipsy moths of New England have been coming closer to the eastern border of New York. One year the gipsy moths of Massachusetts advanced twenty-five miles westward and in three years they have progressed from the Connecticut River valley to within sight of the Hudson River valley. In fact, they have approached so closely that the authorities in New York are uncertain as to whether or not the pests have actually crossed into the forests of the Empire State.

With much larger forested areas and consequently many times the value of the Massachusetts forests represented in the great wooded areas of New York, the advent of the gipsy moth

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TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School, Washington and Monument Sts., Baltimore, Md.

SUMMER WORK FOR GRADUATES IN MEDICINE

Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to **thirty** students, fee $100. Applications should be made to the Dean's Office.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

in this state would be a much more serious matter than in Massachusetts.

Dr. M. W. Blackman, New York State College of Forestry, Syracuse University, head of the department of forest entomology, a member of the conference on the gipsy moth situation recently held at Ithaca, states that the result of the conference was the recommendation of an appropriation of $150,000 to combat this insect. One hundred thousand dollars of this amount is for the Department of Farms and Markets, to be expended in scouting and control work. The appropriation would enable the scientists to establish a dead line from Lake Champlain south along the Hudson River valley to the beginning of the Palisade section, then southeastward into Connecticut. This dead line would traverse lightly forested areas where the progress of the gipsy moth could be fought to best advantage.

Fifty thousand dollars of the proposed appropriation would be given to the state entomologist for investigative work. Dr. Blackman states that practically all of our hardwood and softwood trees are subject to destruction by the gipsy moth. He predicted that if the dead line in New York was established and sufficient amount of continuous preventative work done each year the eastern invasion of the gipsy moth could be checked and probably would be kept from crossing the dead line.

HELIUM FOR NEW AIRSHIPS

Science Service

A change in the method of operation of the new navy airships, ZR-1 and ZR-3, now approaching completion, is announced by aeronautical experts of the National Advisory Committee and of the Navy Department. Helium will be used instead of hydrogen to hold aloft the big dirigibles which are the first of the rigid type to be used by the United States government. The original plans called for the use of hydrogen gas.

No change in the construction plans of the dirigibles will be made as none will be needed. The lifting power of helium is nine tenths that of hydrogen and the difference may be overcome by the carrying of lighter loads. Helium gas has also two great advantages. It is non-inflammable, reducing to a minimum the danger from fire, and its lifting power does not change with the altitude to the same extent that that of hydrogen does.

Flights to the ends of the earth, the north and the south poles, are declared by aeronautic experts to be perfectly practicable in the near future. Bases may be established in Alaska and Southern Patagonia, from which points the distance to the nearest pole is declared to be well within the cruising radius of the air ships. Even if the gasoline supplying the power were to run low the ship could still be navigated so long as it maintained its buoyancy by making use of the winds. German Zeppelin pilots during the war were adept at such methods.

One of the big dirigibles is being built in Germany as part of German payment of claims of this government growing out of the war, and will be navigated to this country with a German crew. The first landing is expected to be Chicago. The other "ship" is being constructed at Lakehurst, New Jersey.

A SEA-GOING LABORATORY TO REDUCE OCEAN ACCIDENTS

Science Service

An experimental ship specially fitted for research in marine physics is proposed by Dr. L. V. King, of the National Research Council's Committee on Acoustics, as an important step toward the reduction of the yearly toll of lives and property resulting from preventable accidents at sea. The improvement in the design of aerial and submarine sound generators offers a large field for scientific effort, he said, and the first cost of equipment to make such study would be more than repaid by the lives and property saved.

The installation at the Fire Island Light near New York Harbor of synchronous signaling by radio-telegraph and by submarine sound, he cited as an example of the kind of things which could be done. This apparatus sends out a series of dots automatically through the ether and through the water, the intervals between them corresponding to the time taken for sound to travel, say, one thousand feet. The ship operator has his telephone connected to the aerial and to a hydrophone. If he counts the number of dots reaching the apparatus before the first of those traveling by water reaches his hydrophone, he evidently obtains at once the distance from the source, reckoning one thousand feet per dot. If his ship is also equipped with a wireless direction finder, he knows his exact location and can thus steer a safe course in fog.

THE SPIRAL NEBULAE

Science Service

Miss Isabel Bevier, of the U. S. Naval Observatory, writes that spiral nebulæ, those mysterious objects in the sky about which astronomers have engaged in excited controversy for many years, are gigantic "pin wheels" according to the recent researches of Dr. Adrian Van Maanen at the Mt. Wilson Observatory of the Carnegie Institution. He has

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observed motion in them similar to that of the familiar decoration of Fourth of July nights, a throwing off of incandescent material from the center outwards in long spirals at a velocity of several hundred miles per second.

As a result of the measurements of the speed at which this material is thrown off, Dr. Van Maanen has derived some conclusions as to the size and distance of these glowing clouds of the starry sky. Some astronomers think that they are complete universes at such a vast distance from ours as to appear to the unaided eye merely as points of light. Dr. Van Maanen believes that he has disproved this theory and shown that the nebulæ are not so far away nor so large as many have supposed.

They are probably only from 3,000 to 30,000 "light years" distant and from 10 to 300 "light years" in diameter, he asserts. To astronomers these are moderate dimensions, as the diameter of our whole universe has been placed at from 30,000 to 300,000 of these units. But to a layman the distances are incomprehensible. A "light year" is the distance light, which travels 186,000 miles in a second, will traverse in a year and amounts to a little less than six million million miles. And at the nearest, these nebulæ are 3,000 light years distant.

The method Dr. Van Maanen used was to compare accurate photographs recently taken of the nebulæ with those taken a decade or more ago and then to measure the distance certain bright spots had moved. Evidence for the "pin wheel" type of motion was clearly shown. Measurements of distance were then made, and as a result the observer concludes that these objects, which are chemically composed of gaseous material heated to incandescence interspersed with stars, are not distant views of independent "island universes" in the abyss of space.

According to the island universe theory the spiral nebulæ are enormous systems of stars and nebulosity intermingled, similar in size and form to our own milky way, but at distances of hundreds of thousands or even millions of light years from it and from our solar system which lies in the Milky Way. At a most conservative estimate the diameter of the Milky Way is approximately thirty thousand light years—according to some astronomers it is ten times as great—so it is evident that the distances and dimensions for the spiral nebulæ required by the island universe theory can not be reconciled with the results of Dr. Van Maanen's investigations.

That no spirals are known to exist in or near the milky way, that they tend to gather in greatest numbers near its poles and also that they are in general receding from the Milky Way at high velocities, are some of the points that have been quoted in favor of the island universe theory. They do not furnish any insurmountable objections to the belief that the spirals are nearer, smaller objects which at most can be only the progenitors of local groups or clusters of stars such as the Hyades or Ursa Major cluster, instead of far distant galaxies. The peculiarities of the spirals, however, that led to the belief that they were island universes still make the origin and nature of these objects an unsolved mystery.

ITEMS

Science Service

By feeding Brown Leghorn chickens dried thyroid glands, Professor Harry Beal Torrey, of the University of Oregon, reports that he has delayed the appearance of normal plumage in the chicks and raised fowls with feathers of different form and color from those fed on ordinary diet. The general color of the poultry which dined on these ductless glands is darker and they did not moult like others of their kind, but the second set of tail feathers grew continuously with the first, apparently pushing out the latter which broke off after a few days. Normally, the first and second set are quite distinct.

To save the little land birds which live only on Laysan Island, a scientific expedition from the Bureau of the U. S. Biological Survey will soon leave for the Hawaiian Archipelago especially equipped to fight rabbits. The multiplication of the prolific bunnies introduced on this once celebrated bird breeding place by a German some years ago threatens to destroy the scanty vegetation of the island. If the vegetation disappears, the rare birds found on this part of the Hawaiian Islands National Bird Reservation will perish. To break this vicious circle, government experts plan to kill off the rabbits. Cooperating in this expedition, which will include other scientific investigations of bird life on the reservation, made up of a dozen or more islands, reefs and shoals which stretch for fifteen hundred miles west of the Hawaiian Archipelago toward Japan, are the Bishop Museum of Honolulu and the American Museum of Natural History of New York. The Navy will furnish a one thousand ton vessel to conduct the scientists to the different islands.

The director of public health of Peru has announced that that country is now free from yellow fever for the first time in its history.

A railroad tunnel 15,700 yards long, which will take about five years to construct, is to be run through Mont Blanc in the Alps.

SCIENCE NEWS

APPROACH TO ABSOLUTE ZERO

Science Service

THE nearest approach to the absolute zero temperature which has yet been attained has been recently achieved by Professor H. Kamerlingh Onnes, of the University of Leyden, Holland, according to advices received by the Bureau of Standards. The record temperature of 272.18 below zero Centigrade, or, as the physicists express it, .82 degrees Absolute, was reached by the Dutch scientist in an unsuccessful attempt to solidify liquid helium. The temperature is equal to approximately 458 degrees below zero Fahrenheit.

At this temperature the liquid helium showed absolutely no tendency to solidify, according to the report of Dr. Onnes, who expresses the opinion that helium may remain a liquid even at the absolute zero.

This temperature, 273 degrees below zero Centigrade, denotes the entire absence of heat, or, expressed in more scientific language, the entire absence of atomic or molecular motion. Heat is due to the vibrations of the atoms. The less heat, the less vibration until, as has been found through mathematical study of the problem, the temperature of —273 Centigrade means the cessation of atomic motion and the entire absence of heat.

Physicists have been trying to attain to this temperature for years because of the bearing that a study of the properties of matter under those conditions would have on the problem of the ultimate constitution of matter. For example, it has been indicated that at the absolute zero the electrical resistance of many, if not all, metals is approximately zero, or, in other words, that although the atoms are entirely at rest the electrons of which they are composed are free to move without the slightest interference.

According to modern theories, an electrical current is a sort of procession of electrons or particles of negative electricity; and it is supposed that at the absolute zero the atoms settle to rest in some form which leaves absolutely free paths through which the electrons may travel without any interference or "resistance."

Every gas has been both liquefied and solidified except helium, which has never been reduced to the solid state in spite of years of effort. In Dr. Kamerlingh Onnes' most recent attempt, he evaporated the liquid helium in the most perfect vacuum attainable, the pressure at the surface of the liquid being only thirteen thousandths of a millimeter of mercury, or about one sixty-five thousandth of an atmosphere. A battery of twelve glass and six iron Langmuir vacuum pumps connected in parallel was used to obtain this result.

The previous attempts to solidify helium having produced a temperature of 1.15 degrees absolute, Dr. Kamerlingh Onnes undertook his latest attempt with the utmost refinement of technic. Although he was unsuccessful in getting any solid helium, he did succeed in getting the lowest temperature ever produced by man. It seems impossible, he states, to get temperatures lower by more than a few hundredths of a degree under those he has now obtained, but he adds: "We can not accept such a limit otherwise than as a provisional one." The pursuit of the absolute zero will continue.

"SLEEPING SICKNESS"

Science Service

ALTHOUGH encephalitis lethargica or "sleeping sickness" is more prevalent in North America than at any time within two years, the total number of cases reported bears but a small relation to the total population. The actual number of cases is not known, as the disease is reportable only in twelve states. Reports for the full year 1922 from thirty-one states and the District of Columbia to the United States Public Health Service give a total of 1,333 cases as against 1,822 for the preceding year.

No accurate figures for the whole country for 1923 are as yet available, according to Public Health Service officials. A severe local epidemic broke out in Winnipeg, Canada, early in January and 85 cases had been reported up to Febraury 26, with 17 deaths. There have been 345 cases and about 110 deaths in New York since the first of the year, or about three times as many as last year. Other cases have been reported in widely separated sections of the country.

An increase in the number of cases of "sleeping sickness" in several countries of northern Europe is announced by the Health Section of the League of Nations. Although the recrudescence was first noted in Sweden, the greatest number of cases has been reported from England and Wales.

The increase began in Sweden in November, when the number of cases jumped from a former monthly average of three to a total of 19 and showed a further increase in December to 45, and in January to 102. England and Wales re-

ported 66 cases in January and 107 for the first three weeks of February as against 52 cases for the corresponding period in 1922. A total of 99 cases has been reported in Switzerland since November, and a few cases have been noted in other countries. During February, encephalitis was present in Poland, and four cities, including Warsaw, registered 32 cases.

When encephalitis first appeared at Glasgow, Scotland, in an aggravated form, public health authorities believed at first that a new malady had made its appearance, but a closer investigation showed that "sleeping sickness" with certain symptoms not present in the 1920 epidemic had recurred. Twenty-six cases have been reported so far.

The cause of the disease is unknown, nor is there at present any definite remedy. Although apparently due to an infection, the disease is not contagious in the usual sense. In 900 cases studied there were no secondary cases in the immediate families of the patients.

The disease is an inflammation of the brain substance with accompanying congestion and frequently with small hemorrhages. It is characterized by great prostration and sleepiness, the patient being literally unable to keep his eyes open and falling into a deep sleep or into a state of coma from which it is sometimes impossible to arouse him. Death occurs in about 29 per cent. of the cases, coming after a few days of profound coma.

It is not a direct sequel of influenza in individual cases, although with one exception every outbreak of it has followed a general influenza epidemic. The disease was first described by a German writer in 1712, and has been known ever since. The first case in the present outbreak in North America, which has continued with varying intensity and distribution, occurred in New York City on September 4, 1918. In 122 cases where definite histories could be secured, the patient had recently had influenza in 46 per cent. of them.

Since about 30 per cent. of the whole population had influenza during the great epidemic, soon after which occurred the cases studied, it may be that in some way an attack of influenza causes susceptibility to encephalitis, but it is not a direct sequel, as most of the victims have not had the "flu."

It has been suggested that influenza causes a lowering of resistance to the sleeping-sickness infection, or that it is due to a separate variety of the influenza germ, which has an affinity for the nerve cells of the brain.

Encephalitis occurs principally in men, and in persons in the latter part of middle age, the ages from 40 to 59 being particularly susceptible. Infants under one year are also susceptible. Old persons are relatively free from the disease, as are those from infancy to 40 years.

A SEAPORT FOR AN INLAND STATE

News Bulletin of the National Geographic Society

THE "Ararat" of a strictly American "Noah," real communist inhabitants, a huge lava flow and salt and sand sufficient to cure most of the world's fish and to keep all its builders and glass factories busy are some of the by-products, valuable and otherwise, that the United States would acquire if it successfully acted on a recently reported resolution of the Arizona House of Representatives. The resolution seeks to add to the state a small triangle of northern Mexico.

It is for quite a different reason, however, that Arizona desires what might be called this "second Gadsden Purchase" of one of the most desolate and least-known regions of North America. The map shows that while the southern boundary of the state extends due west for a space from the southwestern corner of New Mexico, it then strikes northwestward at a very slight angle. The resolution seeks an arrangement with Mexico by which this bend in the southern boundary of the state would be eliminated so that the line would continue as it started, in a due east and west direction. The triangular area that would be added to the state would be about 240 miles long by about fifty miles wide at the point of greatest breadth.

The important consideration is that this long narrow triangle is all that separates Arizona from the sea—the Gulf of California, huge arm of the Pacific. Add it to Arizona, and overnight the state would desert the twenty-seven inland commonwealths and join the twenty-one that border on salt water. With its hundreds of thousands of tons of minerals to ship, the state is now bottled up by a narrow region undeveloped and little likely to be developed by its present owner. It is felt that even the desolate, practically trailless desert, and the lack of natural harbors on the gulf would not deter Yankee enterprise and Yankee engineering ability from laying down a trail of steel and constructing quays or piers at which ocean steamers would soon be loading, furnishing the cheap transportation that bulky products demand.

The areas of most states are well-known, even the parts sparsely populated. It is hard for dwellers in many other portions of the United States to realize, therefore, that not only is this triangle

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

of Mexico a *terra incognita*, but that the portion of Arizona which adjoins it is almost equally so. Most of the region south of the Southern Pacific Railroad may be thought of as a desert on which small broken rocky ranges of mountains have been superimposed. In the valleys between the craggy mountains are numerous patches of fertile soil, but little rain falls, and there are practically no running-streams—only dry stream-beds which now and then carry water for a few hours until it is lost in the sand, and a very few water-holes.

Both north and south of the border, this region is given over almost wholly to a handful of Papago Indians with communistic customs, who range as freely as did their remote ancestors, needing to give in their desolate homeland little or no thought to border-lines, or to the governmental machinery of states and nations. The region—both American and Mexican—is known roughly as "Papagueria," and is seldom traversed by white men.

Through it the international boundary extends the ultimate in arbitrary lines. Swerving neither to the right nor to the left, it extends a straight geometrical line running up sheer cliffs and over craggy peaks, hurdling great valleys and tiny arroyos, crossing deserts, lava flows and sand dunes, until it strikes the Colorado River some fifteen miles below Yuma. And it is imaginary as well as arbitrary. Little monuments from three to five miles apart mark its progress, but these are often obscured, and the Indians and the occasional white or Mexican travelers may, and do, cross and recross it frequently without knowing its location and with no guards or officials to question them.

The Mexican triangle of Papagueria, which it is proposed to add to Arizona, is even a more inhospitable country than the border region. In addition to the features of the latter, it embraces a district thirty by forty miles covered by extinct volcanic craters and an ancient lava flow, and hundreds of square miles of great towering sand dunes that create a landscape like that of parts of the Sahara. On the highest lava peaks of Pinacate, say the old Papago legends, their "Elder Brother" landed from his cask after the deluge and after floating around the world four times. While his solicitude for animals was not as extensive as that of the Hebraic Noah, he at least managed to save a coyote and a beetle. The Papagos formerly were "sand people" living in the sand dune region near the lava fields, with headquarters at the few small water-holes. This region is now practically deserted, the Papagos living by dry-farming and stock-raising farther east and north and making journeys coastward only at intervals for salt.

There is no general knowledge of good natural harbors along the portion of the Gulf of California that would be included in the proposed triangular addition to Arizona, but probably there would be little difficulty in constructing harbor facilities either along Bahia Adair, which would mark the southern boundary of the addition, or northward toward the head of the gulf. The larger sand dunes are twenty miles from the shore near the gulf head and an equal distance from the Colorado River. The most feasible railroad route probably would be from the neighborhood of Yuma, extending roughly parallel to the river.

A NEW HIGH EXPLOSIVE

Science Service

THE latest thing in blasting explosives, cartridges of lampblack soaked in liquid oxygen, was given a trial at a local quarry near Martinsburg, W. Va., recently. The tests were conducted by a representative of a German firm of manufacturers of liquid oxygen apparatus under an arrangement with the United States Bureau of Mines. The test was said to have been successful.

The liquid oxygen explosive has a number of advantages over the older sorts. It can be made on the spot, and the cartridge is perfectly safe until after the liquid oxygen has been poured into the hole into which it has been placed. The hole is then tamped and the cartridge exploded. No poisonous gases are set free by the explosion. If the cartridge fails to explode, it is not a continuing source of danger, but after about twenty minutes the oxygen evaporates from it and it again becomes harmless.

The explosive property is due to the property of finely divided carbon of absorbing large amounts of oxygen when soaked with it in the liquid state. The cartridge explodes owing to an instantaneous combustion of the carbon in intimate contact with pure oxygen. Each cartridge contains about two ounces of lampblack which absorbs about seven ounces of the liquid oxygen.

Owing to the expiration of earlier patents for the manufacture of liquid air, liquid oxygen can now be produced cheaply on the large scale. It is made from liquid air by permitting the nitrogen, which evaporates at a lower temperature, to boil away, leaving practically pure liquid oxygen. The chief expense of its commercial production is said by manufacturers to be the cost of the steel pressure cylinders, tested up to 3,000

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Curator, Woods Hole, Mass.

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

National Research Council

National Research Fellowships in the Biological Sciences

Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1923-24. Appointments may date from July 1 or later. Forms of application and statement of conditions will be furnished on application to the Secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

Applications for early consideration should be in the hands of the Secretary of the Board by April 10, but they may be sent at any time for later consideration, and appointments may be made to begin at any time of the year.

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pounds, which are necessary for long distance transportation; but this is overcome when used for blasting by making it at the mine.

The Germans are said to have made much use of liquid oxygen for blasting purposes during the war. It was unsuitable for a military explosive and was used therefore wherever possible in place of the expensive nitrogen-containing explosives which were essential at the front.

DECREASE OF TYPHOID FEVER

Science Service

THE death rate from typhoid fever continues to decline in the larger cities and for the year 1922 was at the lowest point of record, according to the eleventh annual summary of the deaths from the disease published by the American Medical Association on the basis of official reports from all cities of 100,000 population or more. The total population of these cities, 69 in number, somewhat exceeds 28,000,000, and the total number of typhoid deaths reported was 953, or at a rate of 3.3 per 100,000.

Compared with this were rates of 4.0 in 1921 and 8.1 in 1916.

Generally speaking, the larger the city the lower the typhoid death rate, although the three cities reporting no deaths have neither of them more than 300,000 residents. But every one of the 12 cities with a population of 500,000 or more showed a rate of 5 or less.

Eighteen cities reported rates of 2.0 or less, the three reporting zero being New Bedford, Providence and Yonkers. The three at the bottom of the list of the 69 are Birmingham, Trenton and Nashville, with respective rates of 12.5, 15.9 and 16.2.

According to the report, outside infection is coming to bear a more and more important relation to the total number of city cases. Baltimore, for example, reports cases of outside origin as numbering about 35 per cent. of the total. Philadelphia reports 29 per cent. of the cases due to infection outside the city.

The great decrease in the number of deaths from typhoid within recent years can be measured by comparing the current death rates from that cause with those of a few decades ago. The average for the years 1906 to 1910 inclusive for Pittsburgh was 65, as compared with 4.6 last year; New York, 13.5, as compared with 2.2; Chicago, 15.8, as compared with 1.0; Richmond, 34 and 4.4; Atlanta, 58.4 and 10.9; Los Angeles, 19 and 3.7, and Portland, Oregon, 23.2 and 3.3. These comparisons are typical.

Of the 69 cities reporting, 46 show a diminished and 23 an increased rate for 1922 as compared with 1921. The increases are generally slight, and the report declares that "it seems reasonable to suppose that the city typhoid fever rates will decline further. When a city like St. Paul, with a population of nearly 250,000, can report only 7 deaths from typhoid, three of which were in non-residents, it is plain that typhoid is at a low ebb."

ITEMS

Science Service

FLUELESS, radiant gas heaters of the type commonly used in heating rooms, may cause serious or fatal poisoning from carbon monoxide even where there is no leak in the pipe, according to the United States Bureau of Mines, which has been investigating a number of deaths due to faulty burning of gas heaters. The deadly carbon monoxide is given off as a product of the combustion of artificial or natural gas when the combustion is not complete, due to insufficient air being mixed with the gas. The Bureau of Mines recommends that all heaters have flues, or that a window be kept open in the room in which they are used, that the radiants should not be permitted to glow more than three fourths of the way from bottom to top, and, in general, that the gas flow be controlled by the needle valve rather than by the gas cock, as the greater the gas pressure at the burner the less the chance of the production of the poisonous gas.

A NEW miniature planet has been spotted in the heavens. George H. Peters, observer at the U. S. Naval Observatory, has just announced that he has photographed with the ten-inch refractor an asteroid that is thought to be new. It is now in the constellation of Orion, but it is so faint that it can not be seen with the naked eye. Its magnitude is about 10. The hitherto undiscovered minor planet was first sighted on December 22 at the government observatory as a by-product of the regular observation work, but no announcement was made until a series of positions had been obtained. Mr. Peters has also learned that the planet was independently discovered by observatories in Algeria and Spain about ten days previous to his first observation. There are now about one thousand of these planetoids known and most of them revolve around the sun in between the orbits of Mars and Jupiter. The largest of them is about four hundred and fifty miles in diameter, but the diameter of the new one has not yet been measured. Mr. Peters has discovered other planetoids before.

THE Brazilian Congress of Coal and Other National Fuels has recommended the use of alcohol-driven vehicles by the government and advises promoting the use of fuel alcohol.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

GRAVITATION AND MAGNETISM

Science Service

IF Einstein in his latest work has connected gravitational force and the electro-magnetic field of the earth by a mathematical relationship, he has accomplished a very difficult thing in the opinion of American scientists.

Dr. Louis A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution of Washington, considered the cabled announcements of Einstein's new achievement too meager for comment, but he said to a Science Service representative that he and Einstein discussed such problems when Einstein lectured at Princeton in 1921.

For many years Dr. Bauer and his staff of experts have made the magnetism of the earth and the electricity of the atmosphere their special study. As a result they find that the earth's magnetic and electric fields change markedly at relatively short intervals in a more or less systematic manner. In an adequate discussion of the cause of the earth's magnetism, Dr. Bauer states that it is necessary to take into account both the marked geographical variations in the intensity of the magnetic field, as well as the comparatively large changes from year to year. Thus Dr. Bauer finds that at the equator the intensity of magnetization is about seventeen per cent. greater than at parallels 60 degrees north or south. He further states that the earth's magnetic moment, or its intensity of magnetization, has been diminishing during the past forty years at an average rate per annum of about one thousandth part, or one tenth of a per cent., but it can not be stated at present how long this diminution may continue or whether at some future time an increase may not take place.

As the result of its accumulated data, and its theoretical and experimental investigations, the department of terrestrial magnetism has at present the most complete information for testing any theory concerning the cause of the earth's magnetism.

Gravitation, the force that holds everything to earth and gives everything its weight, varies only by exceedingly small amounts at different parts of the earth, and no such large regular variations with time have been found as in the case of magnetism. The Einstein mathematical relation must take into account these differences betweeen magnetism and gravitation. Dr. Bauer states, however, that the relation may be of such a character so that if, for example, the earth's intensity of magnetization diminishes at the average rate of one thousandth part per annum, as above stated, the earth's gravitational force may change annually only by the square of one thousandth part, or one millionth part—a quantity too small to be readily detected with the appliances at present in use for measuring gravity.

The statement of Einstein that he owes the basis of his new theory to Professor A. S. Eddington, director of the University of Cambridge Observatory, England, is especially interesting, for it was Eddington who first made Einstein known to the English-speaking world by his "Report on the relativity theory of gravitation" in 1918. After the memorable eclipse of May 29, 1919, it will be recalled that the astronomer royal of England, Sir Frank Dyson, and Professor Eddington, announced the confirmation of the predicted amount of deflection of the rays of light passing through the sun's gravitational field, as called for by the Einstein relativity theory. The scientific world is now awaiting with eagerness to learn if the results of the British astronomers are substantiated by the eclipse expedition that was sent from the Lick Observatory, under the charge of the director, Professor W. W. Campbell, to Australia last September.

THE ORIGIN OF LIFE

Science Service

THE production of typical organic compounds, such as are found in green leaves, through the action of ultra-violet light upon air, water and carbon dioxide, was announced by Dr. Oskar Baudisch to the American Chemical Society on April 4, as a process which is believed to give a clue to the origin of life on the earth.

The first step was the formation of an unstable substance called formaldoxime which in the presence of sunlight unites with formaldehyde to form more complicated organic products. Formaldehyde may be made directly from carbon dioxide and water by the action of light. Formaldoxime has the property of uniting with iron and some other metals to form substances in which the metallic character of the iron is masked by the organic character of the compound.

Dr. Baudisch suggested that since iron and magnesium were foremost in the processes of the chemistry of living things, iron being present in the red corpuscles of the blood of all the higher animals, while magnesium is present in chlorophyll, the green coloring matter of leaves, this power of ultra-violet light to build up organic

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Secretary of Cornell University, Ithaca, N. Y.

The Microscope

By SIMON H. GAGE of Cornell University

13th Edition, Published December, 1920

In this edition, special emphasis is put upon the Dark-Field Microscope. POSTPAID $3.00.

COMSTOCK PUBLISHING CO., Ithaca, N. Y.

compounds which will unite with these metals may give a hint as to how life first came to exist.

The iron of the blood carries the oxygen to the tissues, a process which modern medical science has shown to be greatly influenced by light, while Dr. Baudisch stated that the magnesium in leaves possessed a similar power to activate hydrogen in the presence of light. It is his theory that life may have been caused through the direct action of sunlight upon water, air and carbon dioxide in the ancient geologic past when, he believes, sunlight was more intense and contained more ultra-violet light and the air contained more water vapor and carbon dioxide than at the present time.

YEAST AND DIABETES

Science Service

AN extract of yeast that may take the place of insulin, the specific for diabetes, is reported to have been obtained by L. B. Winter and W. Smith in the biochemical laboratory at Cambridge.

Great similarity to the pancreatic extract for treating diabetes which was isolated last year at the University of Toronto has been shown by the newly discovered solid substance from yeast.

According to their preliminary report, "When a solution of this substance is injected into rabbits, a very definite lowering of the blood sugar occurs, in every way comparable to that which we have found after injections of insulin."

Messrs. Winter and Smith, with Dr. Devereux-Forrest, recently showed that there is present in the blood of normal persons a sugar that is not present in those suffering from severe diabetes mellitus. From the effects that extracts of pancreas and liver were found to have on this sort of sugar, and because phosphates which occur abundantly in yeast were found to activate the extracts, the possibility was suggested that yeast would yield a substitute for insulin.

The production of a substitute for insulin from yeast is considered a great step in advance, for it is expected that it will greatly reduce the cost of preparation of an anti-diabetic drug. Insulin is almost prohibitive in cost, since it is difficult to prepare and must be taken continually. Furthermore, yeast is a source far less likely to furnish along with the desired extract such dangerous toxic substances as have caused trouble in the case of the pancreas extract.

Yeast is to-day the source of a number of interesting and possibly valuable substances which are being studied at various laboratories in America and abroad. Dr. Atherton Seidell in Washington at the Hygienic Laboratory and others are preparing from this substance one of the important vitamins and making studies of this life-factor in its effect upon pigeons. At Cambridge a year ago Professor Hopkins, the English biochemist, isolated from yeast a substance which was named glutathione. This is receiving much attention because it is one of the necessary factors in the respiration of living cells. By means of studies with it our knowledge of the chemical mechanism of cell-life is being greatly increased.

ICE AND TRANSATLANTIC TRAFFIC

Science Service

TRANSATLANTIC steamer routes have been shifted south of the usual summer tracks because of the unusual number of icebergs and ice fields south and east of the Grand Banks of Newfoundland, according to an announcement made by the U. S. Hydrographic Office. The decision was made by the steamship companies which are parties to the Transatlantic Track Agreement. It became effective March 30 for eastbound traffic and will be effective April 6 for westbound.

Bergs and field ice have been reported close to the usual summer westbound track which crosses longitude 47 in latitude 41 degrees 30 minutes, and this track will be shifted south a full degree of latitude at that point, or more than sixty miles; the eastbound track being shifted a corresponding distance. Bergs have also been sighted unusually far east, bringing them again close to the normal summer westbound track.

The Hydrographic Office believes that this change is distinctly in the interest of safety of life at sea. It is also in accord with the frequently expressed opinion of the Hydrographic Office that these extra-southerly tracks should be adopted each year not later than April 1.

The Hydrographic Office strongly urged that all other steamship companies not parties to the above agreement also adopt the extra-southerly tracks, to and from the United States, on the dates specified; namely, March 30 and April 6. Unless this be done grave danger of collision will exist between eastbound shipping on the normal summer track crossing longitude 47 degrees west in latitude 40 degrees 30 minutes north and westbound shipping on the extra-southerly track crossing longitude 47 degrees west at the same point, and this menace will be greater than that of ice.

SPRING FLOODS

Science Service

ALTHOUGH damaging local floods, due to ice gorges, are reported from a few sections of the country, there is no prospect for any disastrous or wide-spread floods this spring unless a period of abnormally rainy weather should set in, ac-

National Research Council

National Research Fellowships in the Biological Sciences

Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1923-24. Appointments may date from July 1 or later. Forms of application and statement of conditions will be furnished on application to the Secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

Applications for early consideration should be in the hands of the Secretary of the Board by April 10, but they may be sent at any time for later consideration, and appointments may be made to begin at any time of the year.

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PATENTS AND TRADE-MARKS

SOL SHAPPIRIO, B. Ch. E., LL.B

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cording to Dr. H. C. Frankenfield, in charge of the river and flood division of the U. S. Weather Bureau. The general outlook, in spite of heavy winter snowfall in some northern sections, is, he said, very favorable for no more than moderately high stages along the principal rivers.

A moderate flood is now in progress in the lower Ohio valley and middle Mississippi valleys between Evansville and Memphis, but this will not assume any alarming proportions and will pass down the Mississippi valley without causing any great damage.

Over northeastern sections and especially in New England, where the snowfall has been of almost unprecedented depth, no trouble is looked for unless there should be a heavy, warm rain. About half of the snowfall has already gone off without causing any trouble. Frost is out of the ground beneath the snow and the water is soaking into the ground. A week or two of moderate thawing weather with normal rainfall will remove all possibility of danger. The recent heavy snows over Iowa, Minnesota and Wisconsin are melting without flood conditions, except where ice gorges have formed. In the southeastern states rivers have been at or near flood stages for some time and the possibility of damage is thereby lessened.

Ice gorges have caused floods at Sioux City, Iowa, and along the Delaware River near Port Jervis, N. Y. These are not dependent on the general height of the rivers, the water backing up behind the gorge as behind a dam. Widespread floods are due to long continued rains or to warm rains on snow. Most of the snow is now melted and unless a prolonged rainy spell sets in, or heavy warm rains fall in New England, the dwellers along river valleys are not likely to have to take to the second stories of their homes.

Conditions this spring are decidedly in contrast to those of last year when the biggest flood on record of the whole Mississippi system was recorded.

LEAD PENCILS

The New York State College of Forestry Press Bulletin

MANUFACTURERS of lead pencils are having trouble in finding wood for their factories. The lowly lead pencil requires a special kind of wood and the source of it is becoming remote and limited.

A light, strong, smooth, soft grained wood free from knots, a wood pliable to the knife and patent sharpener, is necessary. The red cedar of the South Atlantic states has supplied pencil wood for half a century. It was so plentiful at one time that farmers built their fences of it. To-day this supply is exhausted and the old fences are sold for pencil wood at a premium. Most of the wood from which pencils are now made is obtained from the Pacific coast.

The California incense cedar is in great demand. Western juniper is also utilized for this purpose, but is knotty and a large portion of the tree has to be made into fence posts and cordwood.

The importance of the supply of wood for lead pencils is better understood when it is known that about one billion pencils are manufactured from American woods every year. Some of the product is exported, but every person in the country, it is estimated, uses approximately seven pencils annually.

One billion pencils represents a product that will probably bring on the average five cents apiece or a total of $50,000,000 annually. This is an astonishing development since the time Romans used metallic lead with which they made marks—whence comes the name of the pencil. Graphite was not utilized in pencil making until the middle ages in Germany. During the reign of Queen Elizabeth a graphite mine was opened in England which gave that country a monopoly of the trade. Later Nuremberg, Bavaria, assumed the lead. In those days turning out pencils was considered part of the cabinet worker's business. A French chemist, Nichols Jaques Conte, discovered how to mix graphite with clay and produce any required degree of hardness. In 1861 the first pencil factory was established in the United States. Southern cedar was so plentiful then that the idea of having to go to the Pacific coast for pencil wood was preposterous. But, like all wood products, the source of the raw material has been retreating westward at a rapid rate. It is predicted that within twenty-five years there will be a timber famine in this country.

A PSYCHO-EDUCATIONAL INSTITUTE

Science Service

ESTABLISHMENT of a psycho-educational institute to provide a central agency where professional services by reliable psychologists, educators, physicians and psychiatrists may be combined on problems relating to the mental development of children, was proposed by Dr. L. L. Thurstone, of the Institute for Government Research, at a meeting of the Washington Branch of the Psychological Corporation on March 31.

Just as parents now take their children to the dentist for examination of their teeth, he pointed out, they might take them to this institution where recommendations as to their mental development will be made from a series of more intensive individual intelligence and educational

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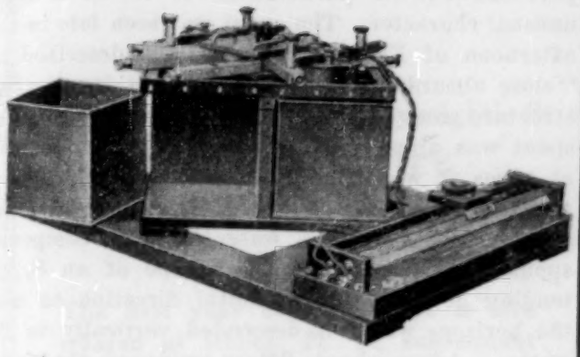

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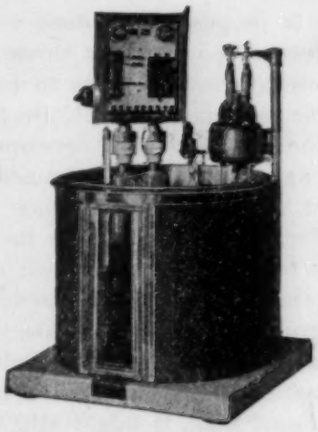

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tests and physical examinations than can be given by the public schools, together with the combined findings of specialists in the different fields.

"If it is proposed to induce a child to cover two grades in one year, or three grades in two years, there are several facts to be considered in making the recommendation," Dr. Thurstone said. "First, the child's mental development compared with its age should be determined by means of the Binet and other intelligence tests. If the child is found to be bright for its age, it will be necessary to consider its physical condition. The physical examination will be made with this particular problem in mind, either by the family physician or by one of the consultant physicians of the institute. If the child's health warrants the additional task, it might still be questionable if the child would be associating with children who are very much older. Consequently, the emotional and social development should be taken into consideration in making such recommendations. This institute will make it possible to get the advice of the different specialists combined in one central agency which, after considering all the factors that entered into the situation, would make the best possible recommendations to the parent."

The institute would also be prepared to give advice regarding the various forms of speech defects so as to combine the recommendations of physicians with the experience of educators and psychologists.

"Such an organization could also give vocational advice," he explained. "Psychologists at work in the college laboratories have developed several lines of technique for vocational advice which the institute can utilize for practical work. It should be the purpose of this institute to make generally available, in the form of professional service, the results of these scientific studies in the psychological laboratories of the college. One field in which reliable service can now be given is that of musical talent. The methods are available for measuring this talent with considerable reliability."

The plan as outlined by Dr. Thurstone further called for careful records to be kept of each child examined, so that the success of the recommendations may be determined from time to time. He proposed that the institute be organized not for profit, but that fees be charged so that it will be self-supporting, while all surplus funds should be devoted to scientific study. A committee was selected to work out more detailed plans of organization.

ITEMS

Science Service

A DOUBLE waterspout, apparently consisting of one spout within another, was observed from the American steamship *Warwick*, about one hundred and eighty miles northeast of Haiti, according to a report made by officers of the ship to the Hydrographic Office. A sketch accompanying the report showed the phenomenon to be of a most unusual character. The spout was seen late in the afternoon of February 22 and was described as "close aboard" so that with glasses its peculiar structure could easily be observed. The inner spout was apparently darker than the outer and at times it would be withdrawn into the heavy globular appearing cloud above, leaving the outer spout still "drawing water". The compound spout was something of the shape of an S, extending in a nearly horizontal direction to near the horizon, where it descended vertically to the water. After about fifteen minutes the inner spout was suddenly withdrawn and ten minutes later the whole mass moved eastward and a heavy rain set in.

MANY reports have come in from all parts of the Punjab of an immense meteor or fire-ball seen about sunset on December 28, 1922. It passed from the north northwest to the south southeast, and was seen generally over northern India. It seemed to travel slowly, left a long white streak, and in one place was followed by a sound like distant thunder. Astronomical calculations give the height of the meteor above the earth at from fifty-four to twenty-nine miles and its speed about twenty-five miles a second.

AN outbreak of epidemic typhus fever among Greek refugees at Constantinople is reported to the health section of the League of Nations. Reports from relief organizations give a total of slightly more than four hundred cases among the refugees since the first of the year. This is more than twice the number officially reported. There are approximately twenty-five thousand Greek refugees in Constantinople and the mortality among them is heavy, 829 deaths from all causes having been reported in five weeks from camps housing about thirteen thousand persons.

A FRENCH astronomical expedition to the upper Amazon in 1731 made a report on native rubber manufacture which first aroused European scientific and commercial interest in rubber.

NAPHTHA and quicklime are supposed to have been the principal ingredients of the liquid fire invented by the old Greek architect Callinicius in 678 A.D. for use in warfare.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

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Dean of the Johns Hopkins Medical School,
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Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to **thirty** students, fee $100. Applications should be made to the Dean's Office.

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Dean, Yale University School of Medicine

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SCIENCE NEWS

SLEEPING FLOWERS AND A NEW ANESTHETIC

Science Service

FLOWERS that persisted in "going to sleep," curling up their petals when they should have been gaily blooming, were the clues to a new anesthetic which Dr. A. B. Luckhardt and J. B. Carter tested successfully as a method of putting animals and men to sleep at the University of Chicago. The flowers were carnations and the gas is ethylene, a constituent of ordinary illuminating gas.

As far back as 1908 florists complained that carnations when placed in greenhouses would "go to sleep" and those which had not opened would fail to do so, causing great loss in their business. Investigation proved leaky gas fixtures to be the cause. Gas contains four per cent. of ethylene, and it was shown that one part of this gas in 2,000,000 parts of air caused already open flowers to close. Other investigations showed a similar effect of the gas on other plants.

Dr. Luckhardt and Mr. Carter recently thought it worth while to test the gas as an anesthetic. It was tried first on numerous animals, such as frogs, mice, guinea-pigs, rabbits and kittens, who were all put to sleep by it successfully without any apparent after effects of a disagreeable sort. Before testing it on men, the anesthetic was finally "tried on the dog," who went out completely in less than five minutes on a mixture of 90 per cent. ethylene and 10 per cent. oxygen, and who was up wagging his tail happily three minutes after the gas had been turned off.

The experimenters then tried it on themselves. They describe the effect of the gas mixed with oxygen as exhilarating and giving a sense of well-being. They became unconscious and then subsequently recovered without realization that they had been unconscious. Several students then volunteered. Complete surgical anesthesia with muscular relaxation was produced in a few minutes. Subjects had pins thrust through their arms, were pinched severely enough to leave black and blue areas, and one was beaten on the soles of his feet with a Stillson wrench without any sensation whatever or memory of discomfort.

Recovery was complete in a few minutes. The only after effect was slight weakness and slight nausea. In every case the subject ate a full meal within a few hours after recovery.

It is claimed that the new anesthetic gives loss of sensation long before complete surgical anesthesia is established, that it may be maintained with complete muscular relaxation, yet without any sign of asphyxia, shortness of breath or effect upon the blood pressure; and that there is rapid recovery even after long administration without evidence of after effects.

It is also stated that it would seem to be of value in obstetrical cases as there is a loss of the sensation of pain from a relatively dilute mixture of the gas, and that it may be used in cases in which nitrous oxide or laughing gas would be dangerous.

SPRAYED COTTONWOODS SHED NO COTTON

Science Service

THE cotton of the cottonwood, the popular shade tree of many American cities, need be no longer a drawback to the tree's utility, according to W. H. Long, of the local station of the United States Bureau of Plant Industry, who has developed a spraying treatment which will prevent the growth of the cotton-bearing blossoms without injury to the tree. The same treatment may be given trees of allied species which blossom before the leaves come out.

It consists of spraying the blossoms as soon as they open in the spring with a very dilute solution of sulphuric acid, preferably of a strength of two per cent. This kills the blossoms which later in the season would otherwise produce the tufts of soft downy cotton that strew the streets and fill the air along streets planted with cottonwoods to the annoyance of the property owners.

It is hoped that this is a solution of the problem of what to do with the large cottonwoods which are the only shade trees in so many western cities, but which because of their "moulting" proclivities are in some cases being cut down or trimmed back severely enough to prevent blossoming for several years. The cost of spraying in this city is between 22 and 32 cents a tree. The treatment might also be of value in eastern cities where streets are shaded either with the cottonwood or the related species of Carolina poplar.

Cottonwood trees are of two kinds. One bears the flowers which later produce the pods in which the cotton is formed. The cotton carries the tiny seeds of the tree and enables them to float for long distances through the air. These cotton-bearing trees are known as pistillate or "female" trees. The other kind of tree, called staminate or "male" trees, do not produce cot-

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13th Edition, Published December, 1920

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ton. Both bloom before the leaves put out, the blooms being borne in short, finger-like bodies known as "catkins." The staminate blooms are purple in color, while the pistillate, or cotton-bearing ones, are greenish, making it easy to distinguish one from the other, an important point, as only the cotton-bearing trees need to be controlled.

As the result of experiment it was found that the following sprays would kill all the blossoms on the trees: crude oil, kerosene, gasoline and dilute sulphuric acid. Saturated common salt solutions killed most of the blossoms and is worthy of further trial because of its cheapness. The kerosene and gasoline sprays were considered efficient but expensive, while the crude oil spray, although effective, was disfiguring to the trees and adjacent property.

The acid spray may be used in a power spray pump, but iron parts in contact with the solution must be replaced by more resistant metal. The solution does not injure paint and is rendered harmless to lawns by watering them immediately before and afterwards. Men operating the pumps should wear old clothes or rubber coats. The solution does not injure the skin if washed off after the job is done.

The trees must in no case be sprayed after the leaves come out, as the acid solution would be fatal to them.

AN ADVANCE IN MUSSEL CULTURE

Science Service

CULTIVATION of the fresh-water mussel during the entire first year of its growth will shortly be undertaken on a large scale for the first time in history by the United States Bureau of Fisheries. This is an important step in making more certain the supply of raw material for the great pearl-button industry of this country.

Heretofore the mussel culturists have largely confined their work to getting the young bivalves well started in life during the brief period when they live a life of ease attached to the gills and fins of fish. For after their first stage of development is passed in the parent shell, they become free-swimming forms with only a tiny shell. Then the little mollusks attach themselves to certain species of fish and for about two weeks live embedded in their foster parents, getting their nourishment from them.

On completion of this stage of the young mussel life, it drops off and settles down to the river bottom to become a regular mussel. There its habits of nearly always eating and having its shell open makes it an easy prey to the hooks of the fishermen.

For some years, the fish experts have engaged in inoculating fish by putting them in a tank with a large number of the free-swimming mussel larvæ. When the proper number had attached themselves the fish were released in the streams. This method, however, did not permit an accurate check upon the effectiveness of the work. Experiments at the Fairport, Iowa, biological experiment station have demonstrated the practicability of holding the fish in large wooden troughs until the parasitic mussels drop off and then keeping the mussels for a year in the wooden tanks of running water where their growth can be observed and more easily controlled. The mussels will then be planted in their natural environment to finish their growth. About 500 species of freshwater mussels grow in the United States, but those of commercial value are practically restricted to flowing waters which drain limestone regions. Most of the streams of the Mississippi Basin and some of the Great Lakes streams are inhabited by these bivalves, from the shells of which are cut many of the buttons on our shirts.

FOOD RESEARCH AND STALE BREAD

Science Service

OLD ideas of how bread stales are overturned by the Food Research Institute, established at the suggestion of Herbert Hoover, in its first publication just issued from its headquarters at Stanford University. The report points out the wholesomeness of the stale loaf, shows the waste produced by present bakery practices and urges further investigation of why some bread keeps better than others.

The assumption that staleness is caused by the loss of moisture from the loaf is not tenable, for the report points out that what probably occurs is that much of the moisture in the bread is held by the starch which has been gelatinized in the baking. As the loaf comes out of the stove, this starch jelly distributed through the bread contains all the moisture it can hold. As the bread cools, the starch gives up some of its moisture, and this moisture is absorbed by the other constituents of the loaf, changing the crust from a brittle material that crunches between the teeth to a soft and pliable one, while the gluten of the crumb is given a toughness and firmness which as fresh bread it did not have. The bread becomes stale at low temperatures and this accounts for the fact that bread when stale, but not dry, can be freshened up by heating. The process is reversed and the starch-jelly reabsorbs the moisture from the other bread constituents.

Losses to wholesale bakers on account of the

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THE SCIENCE PRESS

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arrangement by which they take back the stale unsold loaves from retailers run into millions of dollars a year, the report states. This tends to raise the price of bread to consumers. Before the war the bakeries often lost six to ten per cent. and sometimes twenty-five per cent. from returns of stale loaves, and many a baker has fed his ovens with this wholesome food as a fuel.

Bread a day old is quite as nutritious and to some people more digestible than that freshly baked. If consumers realized this, and bakers were not obliged to accept returns, the country would greatly gain by the economy.

FATIGUE AS A PROTECTION AGAINST PNEUMONIA

Science Service

PHYSICAL fatigue protects against pneumonia if the conclusions based on experiments made upon rats at the Johns Hopkins School of Hygiene and Public Health are found to apply to other animals and to man. The protection even with rats is not absolute, but Miss Ella Oppenheimer and Dr. R. A. Spaeth, who conducted the experiments, have found that the resistance of these animals to the pneumonia infection was greatly strengthened in two cases out of three by exercise prolonged nearly to the point of exhaustion shortly before or after the infection.

The result was a complete surprise to the investigators, as they held to the popular belief that people caught diseases more easily when tired out, and naturally supposed the same rule would apply to rats.

The rats experimented on were made to run in wheel cages like a squirrel until thoroughly tired, the wheels being kept slowly turning by an electric motor. That no permanent injury had resulted was shown by their complete recovery of energy after a rest.

They were inoculated with pneumonia germs after three periods of fatiguing exercise and sometimes they were fatigued for three periods after inoculation. Either way the fatigue seemed to act as a protection against the disease. The number that fell ill was compared with another batch of rats which lived under identical conditions, except for the severe exercise. In only 13 per cent. of the cases were the tired animals more susceptible than the ones which had not been exercised, in 20 per cent. there was apparently no difference, while in 67 per cent. the resistance of the fatigued rats was distinctly greater than that of their normal, rested cousins, brothers and sisters.

The experimenters decline to make sweeping deductions from these experiments, at least in so far as they might apply to human pneumonia. The experiments have attracted much attention and are being continued. Similar ones have shown a like increase of resistance to tetanus or lockjaw infection by fatigued animals.

A touch of "human interest" is injected into the story of the experiment by the fact that the rats disliked the enforced exercise extremely and registered temper by all means at their command. Some were clever enough to learn they could avoid running by lying on their backs with their feet and tails in the air, letting the wheel slip along beneath them. Such individuals were useless for the experiments, but were set aside by the investigators with a certain admiration for their genius.

THE PRODUCTION OF GASOLINE

PRODUCTION of gasoline in the United States in January amounted to 623,823,337 gallons, and established a new high monthly record, according to Secretary of Interior Work. The figures, which were compiled by the Bureau of Mines, show an increase of approximately 39,000,000 gallons or 6.6 per cent. over the previous record month's output, that for December, 1922.

Reports from 301 refineries operating during the month indicated that on February 1 the nation's stock of gasoline amounted to 1,002,857,273 gallons, the largest supply ever recorded. Stocks of gasoline were increased during January by 119,000,000 gallons. Gasoline stocks on February 1 were nearly 300,000,000 gallons in excess of stocks on the corresponding date in 1922.

The indicated domestic consumption of gasoline in January was 443,128,456 gallons, excluding imports for which figures are not yet available.

Refineries operating in January had a total daily indicated capacity of 1,927,667 barrels. Based on the crude oil run to stills, these plants operated at 81 per cent. of their capacity.

Exports of gasoline in January, including shipments to insular possessions, amounted to 61,630,469 gallons.

Domestic production of kerosene in January amounted to 212,447,902 gallons. Consumption of kerosene was 123,214,097 gallons; exports were 94,847,333 gallons. Stocks on hand on February 1 were 275,436,804 gallons, a decrease of more than 5,000,000 gallons during the month.

Production of gas and fuel oils in January is given as 989,376,102 gallons. Consumption of these oils amounted to 931,829,391 gallons. Exports were 97,199,839 gallons. Stocks on hand on February 1 were 1,265,074,722 gallons, a decrease for the month of 39,000,000 gallons.

The output of lubricants in January amounted

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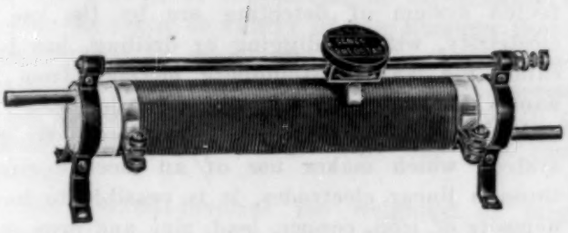

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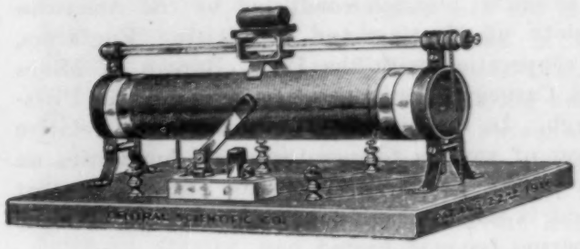

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These rheostats are substantially constructed of white porcelain enameled steel tubing, approximately 12 inches long, wound with oxidized wire of negligible temperature coefficient and provided with the usual form of sliding contact for adjustment of resistance. They may be used either in series with the load or as a potential divider.

No.	A	B	C	D	E	F	G	H	K	L	M
Approx. resist., ohms	2870	1435	715	357	177	89	44	22	11	5.6	2.8
Max. cur. cap., amps.	.38	.54	.77	1.1	1.5	2.2	3.1	4.4	6.2	8.7	12.3
Each	**$6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.25**	**6.50**	**7.00**	**7.50**

4973. RHEOSTATS, Dodge Design, providing a system of wiring whereby a Cenco Rheostat may be connected either in series with the load or as a shunt across the line, the change being made simply by closing a single-throw switch. By means of the slider, the resistance may be varied from zero to the maximum of the rheostat. When connected in series with the load, this variation of the resistances produces a variation in the voltage across the load, the minimum of which is limited by the ratio of the load resistance to the total resistance of the circuit. The current through the load is varied in the same proportion. By this connection it is impossible to obtain very small currents and voltages. By closing the switch and thereby shunting the rheostat across the line, a potentiometer effect is secured by means of which the voltage and current may be varied from zero to a maximum amount, which is the same as the minimum of the series connection.

The rheostats are mounted upon a base of asbestos slate, provided with binding posts for connection to line and load, and with single-pole single-throw switch.

No.	A	B	C	D
For maximum volts	40	110	110	220
Approximate resistance, ohms	11	44	89	177
Maximum current carrying capacity, amperes	6.2	3.1	2.2	1.5
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to 87,077,868 gallons. Consumption of lubricating oils is reported at 49,061,520. Exports were 33,061,486 gallons. Stocks on February 1 amounted to 240,689,649 gallons, a decrease of 5,000,000 gallons during the month.

HIGH TEMPERATURE AND HUMIDITY

Carnegie Institute of Technology

FAT men endure high temperature and humidity better than thin men. This fact has been proved in scientific research conducted by the American Society of Heating and Ventilating Engineers, in cooperation with the U. S. Bureau of Mines and Carnegie Institute of Technology, at Pittsburgh. In experiments to determine the relative effect of various temperatures and humidities on the human body, the scientists also found that sweat is the chief factor causing sore eyes, when a person becomes heated.

Another common belief was blasted during the experiments when they found that the drinking of ice water failed to develop cramps in the men after they had been subjected to an hour's exposure to high temperature.

The object of the research work in Pittsburgh is to establish, by scientific study, the exact degree of temperature, and of humidity, or "comfort lines," a person should be subjected to in a room. The problem was first attacked several years ago, and the research work has now reached a point where definite results have been obtained by the society, which has had the cooperation, also, of the United States Public Health Service. The first experiments have been to study the physiological effects of various temperatures and humidities on human subjects at rest in still air, and, for these, a staff of physicians and employees of the society have subjected themselves to great hardships. The laboratories, located in the Pittsburgh Station of the Bureau of Mines, have been partially equipped by Carnegie Institute of Technology.

One of the important results of the experiments was the discovery of the great variations of external temperature which the human being can endure and, at the same time, retain his physiological efficiency. Another fact discovered was that increasing pulse-rate is more the cause of discomfort than is body temperature, when in a heated room.

ITEMS

Science Service

THE old time magic divining rod used in the search for subterranean treasures has been succeeded by a reliable and accurate electrical set of instruments invented in Sweden and used in the recent discoveries of valuable mineral deposits. The discovery of the rich copper deposits in the Bjurfors field in Central Sweden, already announced, and of the huge iron ore deposits at Kristineberg, which has an estimated capacity of 100,000 tons of high-class ore annually, is definite proof of what can be done by this new system. The invention has been definitely adopted by the government research department, whose head, Axel Gavelin, hails it as of extreme importance to the continued development of Sweden's ancient mining industry. The perfected system of detecting ore by the use of electricity, without digging or drilling, has been called the Nathorst-Lundberg method, from the names of the Swedish inventors who have triumphed after years of experimenting. By this system, which makes use of an electric circuit through linear electrodes, it is possible to locate deposits of iron, copper, lead, zinc and even gold, and to determine their position, length, breadth and general richness, though it may not distinguish between the metals. This method which has been used successfully in Norway and Finland, as well as in Sweden, has been introduced in France and Italy, and has been patented in at least 30 countries.

A BOTTLE drift of unusual distance and duration has been reported by the United States Hydrographic Office. The bottle, enclosing a printed paper with directions for its return to the Hydrographic Office, was thrown overboard about 350 miles southeast of New York from the British steamer *Bloomfield* on February 24 of last year. It was picked up on the southeast coast of Ireland on February 14 of this year, having drifted about 3,000 miles. Four other long drifts have been reported on the Atlantic in recent years. These were of bottles thrown into the Bay of Fundy in August, 1919. One was picked up on the coast of the Azores Islands just a year later, another on the Orkney Islands in January, 1921, the third on the coast of North Wales in March, 1921, and the fourth on the coast of Norway in July, 1921. The shortest of these drifts was 2,000 and the longest 3,800 miles; and if it is assumed that they were picked up soon after having been cast ashore, their rates of drift across the ocean varied between 5.1 and 5.8 miles a day. The bottle recently picked up on the Irish coast had travelled about 8.4 miles a day on the same assumption, the difference probably being due to the fact that it was cast over in or near the Gulf Stream.

BRITISH scientists are experimenting with a trailing thermometer for use by fishermen to discover where in the sea to find hake, a fish said to be guided in its movements by the temperature of the water.

SCIENCE NEWS

WEIGHING OF A CRYSTAL TO TEST THE EINSTEIN THEORY

Science Service

A BALANCE so delicate that it will weigh three pounds with an error of not more than one part in a billion is being used by Dr. Paul R. Heyl, of the Bureau of Standards, in experiments to prove the truth or falsity of the Einstein theory with regard to gravitation. It is the most accurate weighing that science has ever successfully attempted. The results so far are all in favor of Einstein, but are only one fifth completed.

The method involves the weighing of large crystals in varying positions. The largest topaz in the world borrowed from the United States National Museum was one of those used. To obtain results of value the utmost refinement of accuracy was necessary, and to those unacquainted with what a scientist means by that expression, a visit to the laboratory where the work was done would be illuminating. The proverbial princess of the fairy story who felt a crumpled rose leaf under sixteen feather beds was not more sensitive than the balance used in this work.

It is of the general type of chemical balance used for weighing relatively large quantities, but fitted with every latest appliance to avoid error. No human hand comes anywhere near it when it is in use. The crystal to be weighed is first placed in the required position in a sort of frame connected with a series of rods proceeding from the balance case and extending through a brick wall about six feet away. It is then weighed to what would be called extreme accuracy by the experimenter standing in the balance room and putting in the heavier weights by hand. But that is all merely preliminary to the main show.

The whole balance is then encased in movable walls of cork composition about two inches thick, leaving just room enough for the control rods and for the reflection of a beam of light from a lamp outside the chamber wall to shine through and onto a mirror, the swings of which measure the final balancing. The experimenter then leaves the room which is closed tightly with a double door and left to come to a uniform temperature.

This takes nearly an hour, after which the room does not vary one tenth of a degree from one part to another. It is most important that the two arms of the balance shall not vary in temperature by more than one thousandth of a degree, as this would introduce into the experiment an error of one part in several million, which would ruin its value. The weighing is then made by the operator sitting outside the brick wall and controlling the final delicate weights with the rods projecting through it.

One of the refinements introduced is the use of weights equal in volume to the crystal and supporting frame. The weights and the crystal both displace air as substances sunk in water displace water. If they differed more than two or three per cent. in volume the varying amount of air displaced would introduce a serious error.

Another refinement is to keep the center of gravity of the crystal to be weighed at the same level. The farther from the earth the less the force of gravity, and although an object would have to be carried miles up in the air before it would lose an appreciable part of its weight, a change of less than half an inch would be detected by this balance.

According to all the theories of gravitation from the time of Newton to Einstein, it is caused by some sort of mechanical stress either in the nature of a pull or a push upon the things mutually attracted. If this were true, it is expected that crystals would be attracted more or less to the earth and would vary in weight according to the position in which they are placed, for in a crystal the atoms all lie the same way in a sort of lattice formation, and the amount of resistance they would offer to the impact or pull of gravitation would vary according to the way they were placed.

Einstein says, on the contrary, that gravitation is like the force exerted on a string by a whirling object tied to it; and that it is due to a whirling of the four dimensional universe, which he assumes, in an additional fifth dimension. Dr. Heyl's experiments so far show that Einstein is right. If he really is, there is no cure for gravitation except to iron out the four and five dimension curves which he assumes, or to stop the whirling. Dr. Heyl offered no solution to these problems which Einstein admitted in a recent reported interview could not be expressed in words.

THE CAHOKIA MOUNDS

Science Service

THE famous Cahokia mounds, lying in the rich American bottoms not far from the junction of the Missouri and Mississippi rivers and near East St. Louis, Illinois, are the remains of the largest prehistoric city in the United States, W. E. Myer, archeologist, declared on his recent return here

from a visit to this site, which is now being excavated by Professor Warren K. Moorehead, curator of the department of archeology of the Phillips Academy, Andover, Massachusetts, under the auspices of the University of Illinois. Unless action is soon taken to preserve these great mounds, he said, the rapid spread of modern factories in the outskirts of this important manufacturing Illinois city may completely efface the ruins of this ancient Indian metropolis, which exceeds in size any other city occupied by prehistoric man in the United States.

The University of Illinois and also a large number of prominent men throughout Illinois and the adjoining states are very much alive to the importance of having an experienced archeologist like Professor Moorehead to explore carefully and study these great mounds. There is now a bill before the Illinois legislature to appropriate sufficient money to purchase the site of this ancient city and to set it aside as a state park for the pleasure and education of our people forever. They feel that to allow these great mounds to be destroyed would be almost a crime against future generations.

There are eighty mounds in this great Cahokia group, scattered over an area of about two thousand acres; but the extreme limits of this old city are still unknown. The largest of these mounds, known as the Cahokia mound, is by far the largest ever raised by prehistoric races within the boundaries of what is now the United States. This mound is about 998 feet long, 710 feet wide and rises above the surrounding country to a height of over 90 feet.

These vast earthworks probably at one time contained on their summits temples and chiefs' houses and other important structures.

No accurate estimate can as yet be made as to the date when the mounds were erected or the number of people required to build them. Some of the smaller mounds in this group may possibly be burial mounds, as modern Indians have been known to raise mounds over the bodies of some of their powerful chiefs or over large numbers of their less important dead.

Several years will be required to complete the exploration of these ruins. Although they have been known to white men for over two hundred years, there has been little intensive exploration of them until the University of Illinois expedition under Professor Moorehead began work in 1921. It is hoped that this expedition, which is now in the field, will unearth sufficient evidence to enable them to determine what ancient Indian tribe erected these great mounds and lived in this large city.

The builders of these mounds were not a separate race, Mr. Myer added, but were our ancient American Indians. These mounds have been called the Cahokia group because the Cahokias, a small tribe of a few hundred Indians, were found living in the vicinity when the first white explorers came into the region. The Cahokia Indians did not live upon these mounds. They did not and could not have built the ancient city. The Cahokias stated that they found these great ruins of a vanished tribe lying silent and deserted when they first came into the region. No one could tell them who built them, or when or why the vast population perished or departed.

WEATHER FORECASTS AT SEA

Science Service

THE extension of the daily weather forecasts to cover the entire North Atlantic ocean is characterized as an imminent development of meteorology by Major E. H. Bowie, chief forecaster of the United States Weather Bureau, who has recently returned to Washington after a round trip to France on the French merchant training steamship *Jacques Cartier*. The trip was undertaken under the direction of Professor C. F. Marvin, chief of the United States Weather Bureau, to determine the feasibility of making daily weather maps and forecasts at sea, and, according to Major Bowie, was a complete success. Forecasting at sea is entirely practicable, he says.

The trip over and back lasted about six weeks and every day of that trip the forecaster was able to make a morning and night weather map showing conditions over the whole North Atlantic, western Europe and the whole United States and Canada. Reports were received by radio from vessels at sea, from the Navy station at Arlington, and from the French station at the Eiffel Tower.

Forecasts for the whole ocean between the tropics and the latitude of Iceland were made and broadcast every day from the *Jacques Cartier* at noon, Greenwich time. The reports from vessels were relayed to Europe and to America, where they were of great value to forecasters there through informing them of storms which were on their way across the ocean.

"There was no difficulty in getting enough vessels to furnish us with data," Major Bowie said. "They were anxious to cooperate and fairly hungry for the forecasts. This was true even of the big liners which hold their courses irrespective of the weather. They wanted to know what they had to face."

The forecasts were made for the principal steamer tracks, such as from the Azores to Ber-

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The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School, Washington and Monument Sts., Baltimore, Md.

SUMMER WORK FOR GRADUATES IN MEDICINE

Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to **thirty** students, fee $100. Applications should be made to the Dean's Office.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

muda or Gibraltar or Great Britain, or from north European ports to Newfoundland and New York. Special warnings of the approach of storms of unusual intensity were given.

It is entirely practicable to put out daily forecasts at sea and to broadcast them by radio for hundreds of miles. "It would be inexpensive if the principal maritime nations cooperated. Experienced meteorologists and forecasters could be distributed on vessels so that one or two would always be at sea. They would receive the reports from other vessels and from land stations, get up the daily forecasts and broadcast them, and relay the vessel reports to land where they would be of great value. The weather of the ocean can be charted just as easily as that on the land, with results of great value both afloat and ashore. It is a field of work which has been greatly neglected and its development will be the next forward step taken in meteorological science."

BRAIN CELLS UNHURT BY RAYS THAT KILL TUMORS

Science Service

A CLUE to the mystery of cancer, of possibly great importance, has been discovered by scientists at the Memorial Hospital for the Study of Cancer and Allied Diseases, who have found that while X-rays and radium rays have a destructive effect upon tissue cells, especially on the cells of cancer tissue, the cells of the brain are more resistant to their action than those of any other part of the body. Brain cells and cancer cells stand at opposite ends of a scale of susceptibility to the invisible rays.

The immediate practical bearing is in the treatment of brain tumors, which because of the delicate construction of the vital brain tissues which surround them, are frequently inoperable surgically. They may now be treated by X-rays or radium rays, as a treatment strong enough to damage the tumor or cancer is not injurious to the brain tissues through which the rays also pass. While X-ray treatment always has the danger of damage to healthy tissue, it has now been shown that such treatment of growths in the brain may be carried on with a wider margin of safety than is possible in other parts of the body.

The work at the hospital has been carried on chiefly with radium. The institution has one of the largest supplies in the United States; four grams of the precious metal having been given the hospital in connection with a laboratory for its use by the late Dr. James Douglas.

The three sorts of radium rays, known as alpha, beta and gamma rays, vary in their penetrating power and destructiveness, the alpha being the most destructive, but the least penetrating. The alpha rays are accordingly filtered out by screens of platinum through which the gamma rays pass to exert their effect in the interior of the brain. In some cases the radium emanation which gives off the rays is enclosed in platinum-cased glass capsules and inserted directly into the brain tissue, the capsules being sometimes as small as an eighth of an inch in diameter.

Explanations of the comparative resistance of the healthy brain tissue to the effect of the rays which are destructive to tumor or cancer cells, and to a less extent to other body tissues, are being sought, as it is thought they will have an important bearing on the problem of what causes cancer.

WATER POWER PLANTS GIVEN NEW IMPETUS BECAUSE OF COAL SITUATION

Yale University News Statement

ACCORDING to Arthur T. Safford, consulting hydraulic engineer of Lowell, Massachusetts, who is giving a course of lectures on water conservation at Yale, many water power plants are being developed as a result of the acuteness of the coal situation. In New York state the production of electricity during the last ten years has more than doubled, while the use of coal has increased but 50 per cent. Instead of cheap coal, cheap water power is building up the Pacific coast and the south, and is one reason for New England's remaining an industrial center. New England has seen her comparatively small total water power of ten years ago more than doubled through the construction of hydrostations of the Central Maine Power Company, New England Power Company, Turners Falls Power and Electric Company, and the developments in the great textile cities of Lowell, Lawrence and Holyoke, Massachusetts, and Manchester, New Hampshire.

New York state is developing water power from the Barge Canal, and Henry Ford is making an interesting development at the state dam at Troy, New York. Installations of water power, and most of it of the most modern kind, increased from 4 million in 1912 to 8 million developed horse power in 1921.

The recent construction of the New York City and Los Angeles, California, water supplies, the flood control work of the Ohio River Valley, the Ripogenus storage of the Great Northern Paper Company, Maine, and the very recent Dead River storage of the Upper Kennebec River in Maine are interesting examples of water storage which will be followed by studies for similar water supplies and water storage on many of our streams.

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Many power and storage projects are being built abroad, one in South Africa called the Lake Mentx Conservation Works along the lower reaches of Sunday's River. The dam impounds 25,700,000,000 gallons of water and submerges 4,900 acres. This dam will furnish water for intensive cultivation for about 40,000 acres in the Sunday's River valley. France with only 930,000 horse power of hydro-electric power in 1913 was producing some 2,100,000 horse power in 1921 and many new projects are being studied.

In spite of all the developments in Canada, it is said that 94 per cent. of the water power is idle, and some one has estimated the total water power of Canada at 41,700,000 horse power.

One of the greatest water storage and water supply projects abroad which has been built and operated for industrial and water supply purposes, and built at a greater cost than has been thought economical for this country, is in the Ruhr region of Germany.

New England, although alive to the needs of power, has been surpassed by the great developments at Niagara Falls on both American and Canadian sides, the Mississippi River at Keokuk, and the high head developments of the Pacific coast. Formerly a hydro-electric development was made in advance of transmission lines and a market; now the transmission lines often become the feeders for power sold at wholesale by more than one company. Like the railroads, they are reaching out in all directions, but for power rather than customers.

NEBULAE IN THE SOUTHERN SKIES

Harvard News

New light is thrown on the number and distribution of nebulæ in the southern skies by the discovery by Harvard astronomers of no less than 850 nebulæ on a single telescopic photograph, covering an area of about 30 square degrees, taken at Arequipa, Peru, according to a bulletin issued by the Harvard College Observatory.

The photograph was made at the Harvard astronomical station at Arequipa on September 19, 1922, with the powerful 24-inch Bruce telescope with an exposure of six hours. The new nebulæ, discovered at Cambridge when the plate was shipped here for examination, "are not of the nature of the faint irregular nebulous wisps frequently found in the vicinity of bright spirals," says the bulletin. "Rather, they are distinct nebulæ, the fainter ones almost exclusively oval or circular in form. . . . The brighter nebulæ, almost without exception, are elongated, or show spiral structure, while the fainter appear to be largely globular."

The announcement recalls the discovery last summer of two thousand nebulæ on ninety earlier photographs made at Arequipa with the same telescope. Much less is known to date about the southern than about the northern nebulæ, and these investigations are being pursued in order to supplement the very incomplete data possessed by astronomers.

"It is generally believed," states the observatory bulletin, "that the northern galactic hemisphere is richer than the southern in nebulæ of the spiral family. For the spirals and spindles brighter than the tenth magnitude this belief apparently is justified; but it may depend to some extent on the incompleteness of the surveys of the southern sky. We know little as yet concerning the distribution of the fainter nebulæ of this class, except that they are relatively infrequent near the galaxy (or milky way) and that there is a tendency to form loose clusters."

ITEMS

Sunspots have no determinable influence on the temperature of the United States as a whole, according to Professor Alfred J. Henry, of the United States Weather Bureau, who spoke before the American Meteorological Society in Washington on April 16. He spoke on the results of a study of sunspot frequencies and temperature deviations in this country for more than a hundred years. The years of minimum sunspots coincided with years of general high temperature in five out of ten cases, there was a negative fluctuation in three cases and exactly normal temperature in two. On the other hand, the years when there were the greatest number of sunspots were usually cold in five cases and unusually warm in an equal number. Evidence was found of the existence of short temperature cycles of irregular length, warm and cold years sometimes alternating and at other times occurring in groups of 3, 4 or 5 years. It is difficult, the speaker said, to connect these directly with changes in solar radiation, stating that it was difficult, if not impossible, to disentangle the network of influences which produce fluctuations in terrestrial temperature changes, and that it was hopeless to look for effects of temperature changes from solar radiation in the case of the northern states east of the Dakotas.

Only two centuries ago beavers inhabited the greater part of the North American continent and were an important source of food and warm clothing to the natives.

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NEW HAVEN, CONN.

SCIENCE NEWS

DECREASE IN THE SUN'S HEAT

Science Service

THE sun has been suffering from a chill and the past winter has been one of the most unusual and the present spring one of the latest of record, according to Dr. C. G. Abbot, home secretary of the National Academy of Sciences. A paper read by him on the falling off in the sun's heat as measured at astrophysical stations of the Smithsonian Institution in Arizona and Chile was one of the sensations of the meeting of the National Academy. The central heating plant of the solar system is apparently working from three to four per cent. less activity than 15 months ago.

Dr. Abbot did not draw any conclusions between the sun's failure to perform and the over-performance on the part of the weather, but contented himself with entitling his paper, "The solar prelude to an unusual winter," and stating that it would seem to do no harm to call attention to both phenomena in the hope of fruitful investigation. He did not hesitate, however, to describe the drop in the sun's heat as "extraordinary," and to say that nothing so outstanding in the way of a change in the heat of the sun had been observed since measurements were begun in 1905.

The drop followed a number of years during which the sun's heat had been running above the normal and began in November, 1921, continuing steadily until the lowest figures were reached towards the close of the year 1922. Results for recent months have not been figured out as yet as the calculations take a long time.

Dr. Abbot gave no explanation of the sun's cooling off nor any prediction as to how long it might continue. He said the result was certainly due to causes outside of the earth's atmosphere as all effects from such causes were allowed for. It must be due to conditions in the sun or its immediate surroundings.

As to the possible effect on the weather, Dr. Abbot said nothing so simple as general coolness should be expected, for the earth is too complicated with deserts, oceans and clouds for that. He quoted from reports of the Weather Bureau which showed that 1921, the year before the decline in the sun's heat began, was the warmest of record for the last 50 years, taking the country as a whole. Last year showed a slight decline but was still above normal as was the early part of the past winter. But in December, three months after the sun had cooled to near the lowest point, unusual contrasts occurred. The southeastern states were warmest and northwestern ones coldest for 30 years. In January unusual storminess prevailed and the storm tracks followed strange courses. These conditions continued into February and the temperature began to average below normal, especially in northern and northeastern sections. New England has experienced one of the heaviest snowfalls for the entire winter ever known. March was generally below the normal temperature in the same region and the latter part of the month and the first days of April brought the most severe cold wave ever known so late in the season in the country east of the Mississippi Valley.

Although not referred to by Dr. Abbot, the winter has been unusually stormy at sea and icebergs are so prevalent in the North Atlantic that the usual southerly steamer tracks for the ice season have been shifted further southwards. Reports from the Great Lakes at the end of March stated that the ice conditions of the upper lakes were approximately those of mid-winter and that in the judgment of experienced navigators the St. Mary's river and the Soo locks would not be passable before May, or weeks later than normal.

Dr. Abbot and his associates will continue to keep the sun under observations until July, 1925, at least. Two stations are making daily determinations of how much heat the sun radiates. One of these is 5,800 feet above sea level on the top of Mount Harqua, Hala, Arizona, and the other is at an altitude of nearly 9,500 feet on the top of Mount Montezuma, Chile. It is an absolute desert where less than an inch of rain has fallen in 20 years. At these isolated stations, above dirt and dust of ordinary places, scientists of the Smithsonian Institution are able to observe the sun nearly every day because of the infrequency of clouds.

A SLUMBERING VOLCANO

Science Service

A VOLCANO which won't play is holding up an important proposed research by the Carnegie Institution of Washington on the constitution of volcanic gases. The money is ready, the scientists have assembled their apparatus and are waiting to be told the volcano is performing, but the volcano, apparently unaware that it is holding up the progress of science, is still on a vacation.

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GEO. M. GRAY,
Curator, Woods Hole, Mass.

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The volcano is one of the big ones of the Hawaiian Islands and the tidings of its misbehaviors were related to the assembled scientists of the American Geophysical Union who met recently in Washington. It is a volcano especially noted for its usual eructations of hot gases, the composition of which is not well known as the gases are generally red hot when they escape and it is a little beyond the hardihood of the most intrepid scientist to catch the incandescent vapors in bottles for analysis.

But science has a long distance weapon of research for just such cases, the spectroscope, the same instrument by which the composition of the incandescent gases of the sun and the most distant stars is determined. So it was arranged that a group of expert spectroscopists from the Mt. Wilson Observatory in California should take a jaunt out to Hawaii with their scientific artillery, set it up at a convenient distance from the volcano some dark night and proceed to determine the constituents of the volcano's breath at long range. Analysis of volcanic gases is important as a clue to what causes volcanoes, and when that becomes known it may be possible to predict future eruptions with great saving to life and property. Hence the interest of the scientists in the investigation.

To all of which the sleeping volcano is deaf and dumb. No alarm clock will arouse it, nor pleadings move it. While the scientists wait impatiently, fuming meanwhile in imitation of the volcano's own frequent activity, it slumbers on with the large indifference of Nature in general to the performances of man, her latest toy and would-be cut-up of the universe. When it gets ready, the volcano will erupt; meanwhile not even scientists can move it.

NEW COMPASS PERFECTED

Science Service

A DEVELOPMENT of the new "earth induction compass" similar to that designed for airships but intended for vessels at sea has been practically completed by Dr. L. J. Briggs and Dr. Paul R. Heyl, of the U. S. Bureau of Standards, and is ready and waiting for a sea trial on some vessel of the navy. It is larger than the one used in planes, actuated by an alternating current motor instead of wind cups, and is more heavily built; but the principle is the same.

Two direct currents are generated by revolving two pairs of brushes at a velocity of about 1,400 revolutions per minute in the magnetic field of the earth. The instrument is so adjusted that when set for a compass bearing the currents flowing from each pair of brushes are equal and produce no effect on a galvanometer. If the instrument turns even slightly one current becomes stronger and the dial needle is deflected.

The advantage of the instrument for war vessels is that while the generator may be put in a fighting top and the greatest possible distance from any effect of the magnetism of the metal of the ship, the control dial may be on the navigating bridge. In contrast to the gyroscopic compass, now in use on many vessels of the navy, the new compass is inexpensive and within the reach even of the smaller merchant craft.

MALARIAL TREATMENT FOR PARESIS

Science Service

THE new malarial treatment for paresis, said to have been tried with great success in Europe and which is now being used on paretic patients at St. Elizabeth's, the U. S. Government Hospital for the Insane, seems worth trying in cases of locomotor ataxia, at least in the early stages, according to Dr. W. A. White, superintendent of the hospital. No trials of it have been made there as there are no sufferers from the disease in the institution.

Locomotor ataxia, or tabes, as the medical men call it, is, like paresis, one of the sequels of syphilis. It is a degeneration of part of the spinal cord, causing generally no mental deterioration, but a gradually increasing disability. The disease may be arrested by anti-syphilitic treatment, but cures are rare.

Although it will be years before the results of the malarial treatment of paretics at St. Elizabeth's will be definitely known, experiments made in Europe indicate that infection with a mild type of malaria, known as the tertian, will in time arrest and even improve cases of paresis which are entirely hopeless. Since tabes and paresis both have a similar origin in syphilitic infection it was suggested to Dr. White that the same treatment might be good for both.

"It would seem to be worth trying," he said. "I know that if I had tabes I would take a chance on it for the results obtained abroad on the malarial treatment of paresis are apparently extremely favorable. I know Dr. Weygandt, of Hamburg, who had reported some of these cases and know him to be most conservative in his statements. His results and those of others in Austria were so decidedly hopeful that we tried the treatment here. It is too soon, however, to say with what success.

"The first treatments were given two paretic patients some months ago. These cases have apparently grown no worse, but paresis is a disease which while under former methods of treatment of utterly hopeless outcome, still has periods of arrest, and it is possible that may be the

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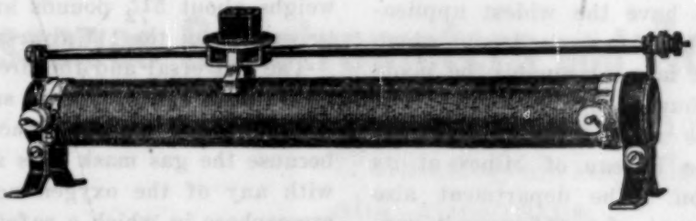

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cause of the stationary condition of our two patients. Recently we injected 15 paretics with tertian malaria, but it will be two or three years before we can say whether it has a definite remedial effect.

"Little is known of the physiological method of the remedy, but it is thought that the same anti-bodies in the blood which the body produces to fight the malaria germs are fatal to those of the syphilis. It is true that patients who have apparently been greatly benefited by the treatment still show a Wassermann blood test for syphilis, but we are coming to learn that the test may result from other conditions, among them malaria."

Dr. White was asked if it were possible that the malaria germs actually ate up the germs of the more serious disorder, that the blood of the patient was a battleground between two invading hosts. It was not likely, he said, the explanation that the same set of nature's antidotes for one poison proving effective against the other seeming the more reasonable, and it was this theory that made the possible use of the treatment against locomotor ataxia seem possibly worth trying, although so far as he knew it had not been as yet.

A UNIVERSAL GAS MASK

Department of the Interior

DEVELOPMENT of a "universal gas mask" which is considered to have the widest application of any gas mask thus far devised, and which fills every demand that may reasonably be made on a gas mask, is announced by the Department of the Interior as the result of experimental work performed by the Bureau of Mines at its Pittsburgh, Pa., station. The department also announces the development of a "fireman's canister" which is similar to the "Universal canister," but is smaller and lighter, thus making it more convenient for the use of city fireman. By the use of these types of gas masks, workers in many metallurgical and chemical plants may encounter a variety of gases and city firemen may meet almost any type of gas or vapor, and do work that they could not do otherwise except at the risk of death or serious disability.

The army gas mask as developed during the war gave protection against all the poisonous gases, vapors and smokes encountered on the field of battle. But when, after the war, army-type gas masks were advocated for use in metallurgical, chemical and other industries where noxious gases or fumes occur, the Bureau of Mines immediately pointed out that the masks give no protection against ammonia gas used in refrigerating plants, or against carbon monoxide, a constituent of blast-furnace gas, producer gas, water gas and coal gas. Carbon monoxide is formed by the incomplete combustion of carbonaceous matter and is a constituent of the gases from certain explosives. Recently, special gas masks having canisters containing absorbents designed for protection against ammonia or from carbon monoxide have been developed, but these afford little or no protection against other gases.

To combine efficiently in one canister the absorbents for all noxious gases is difficult because the absorbents for certain gases are best when moist, whereas an absorbent or catalyst for carbon monoxide can be used only when perfectly dry. Hence it becomes necessary to use dry absorbents for the other gases.

After an extended series of experiments by the Bureau of Mines the "Universal" gas mask was developed. The canister contains granular absorbents, consisting of activated charcoal, for removing organic vapors; a filter of cotton wool for removing smokes, dusts, and mists; caustic soda fused on pumice stone for removing acid gases; another cotton-wool filter; fused calcium chloride for extracting water vapor that inhibits action of the next absorbent; "hopcalite," a mixture of oxides of manganese and copper with sometimes silver and cobalt that detroys carbon monoxide; and finally silica gel for absorbing ammonia. The complete mask and harness weigh about 8½ pounds. The "Fireman's canister" weighs about 5½ pounds and is more convenient to wear than the "Universal" mask.

The universal and the fireman's gas masks may be worn in air containing small quantities of any noxious gas. An abundance of air is necessary, because the gas mask does not furnish the wearer with any of the oxygen necessary for life. An atmosphere in which a safety-lamp flame goes out must never be entered by a man wearing a gas mask. Oxygen breathing apparatus or air helmets only can be used in such places.

Most noxious gases may be detected by their odor or taste when they penetrate a canister, either because of its being exhausted or of its activity being insufficient to absorb a high concentration, so that one has time to escape from a dangerous atmosphere before he has breathed enough of the gas to cause injury. Carbon monoxide, however, has no taste nor odor; a man who breathes it may not be aware of it presence until he becomes greatly weakened or nauseated; he may lose consciousness without receiving any warning. Because of the danger from using an exhausted canister, a limit of six hours' use is put upon the universal and four hours' on the fireman's canisters.

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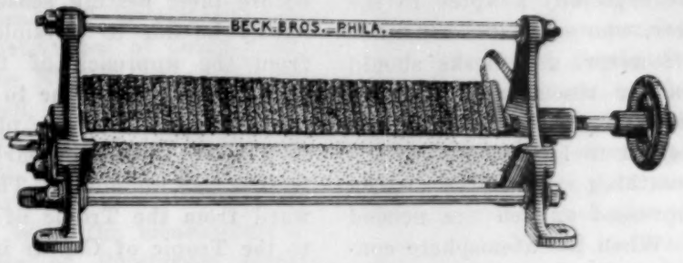

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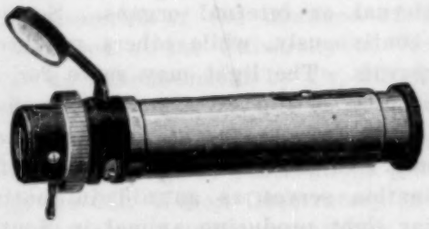

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worn under a coat because when warm they are more active against carbon monoxide than when they are cold.

Masks of the universal type are useful for emergency purposes around chemical plants or the like in which many different gases or vapors may be met. They are especially adapted to the work of city fire fighters, who encounter all kinds of poisonous gases. However, gas masks should not be used in mines for rescue and recovery purposes after explosions, because at such times the mine atmosphere is apt to lack oxygen. Self-contained oxygen breathing apparatus which carry supplies of compressed oxygen are needed for mine rescue work. When the atmosphere contains enough oxygen to support a lamp flame the universal or the fireman's gas mask will give protection against the most gaseous hazards.

Tests of the Universal gas mask in actual service have totaled 14 hours without signs of failure. The arbitrary life of 6 hours has, however, been adopted because of the inability of a wearer to detect penetration of carbon monoxide; penetration of other gases may be detected by taste or smell. A canister fails gradually, so the wearer has time to escape from a dangerous atmosphere before the concentration of gas breathed becomes hazardous. The "Fireman's" mask has a shorter life than the "Universal" mask—4 hours as compared with 6 hours. Both figures allow a large factor of safety.

Details regarding these gas masks are given in Technical Paper 300, by S. H. Katz, J. J. Bloomfield, and A. C. Fieldner, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

ITEMS

Science Service

THE coldest days are the most unhealthful and are followed by a sharp increase in the death rate in New York, according to a preliminary report of the committee on the atmosphere and man of the National Research Council. The most healthful weather is when the outdoor temperature ranges between 60 and 75 degrees, extremely hot weather being almost as unfavorable as the opposite extreme. The committee suggested that the rise in the death rate in cold weather is not due principally to the cold, but to the bad effect of the over-heating of houses and the severe changes in temperature involved in going from them to the cold air outdoors. This high winter death rate is therefore probably preventable.

DESIRE to save all the available daylight and not increasing warmth or means of sustenance are the causes which start the birds on their annual northward migration, according to the belief of Professor C. W. G. Eifrig, of the department of geography and nature study of Concordia Teachers College. "Many species come north as early as February or March, months before their nesting season," he said. "It can hardly be due to physiological changes resulting from the approach of the mating season, nor does it seem to be due to a desire on the part of the birds to visit the place of their birth, for they leave sometimes early in the summer while food is still abundant. The long days come northward from the Tropic of Capricorn in December to the Tropic of Cancer in June, the time of our longest days, and also the time of the greatest activity in bird life. It is my theory that these migrations of the birds are due to their desire to be always where there is the most sunlight."

ANIMAL illumination is not so simple a procedure as it might appear to be. According to Professor E. Newton Harvey, of Princeton University, and Dr. W. R. Amberson, of the Nela Research Laboratories, Cleveland, not only is a substance called "luciferin" necessary for animals to "light" themselves, but also another substance, "luciferase," must be present. The investigators showed that these chemical compounds producing the light are so specialized that the luciferin of one animal will not cause luminescence with the luciferase of an animal of different species. For a long time it has been known that water and oxygen are also essential for light production. More than thirty widely scattered groups of animals produce light either by means of external or internal organs. Some produce light continuously, while others produce it only at intervals. The light may serve for a variety of purposes, acting as a lantern for fish in the dark depths of the oceans, or serving as a lure for prey. In the case of the ordinary firefly, its illumination serves as an aid in mating. One peculiar light producing animal in South America has a white "headlight" and a rear "taillight," and is consequently known as the automobile bug.

MOST forest streams are slightly acid—a condition known to be well adapted to trout—but forest fires often cause a deposit of ash which gives the streams an alkaline quality most destructive to fish life.

THE United States produces about two thirds of the world's talc, the mineral used in the manufacture of paper, paints, crayons, gas tips, electric insulation and talcum powder.

SCIENCE NEWS

THE DISTANCE OF BETELGEUSE

Science Service

THE astronomers have finally taken the measure and determined the distance of Betelgeuse, the giant red star in the constellation of Orion. At the recent meeting of the National Academy of Sciences, Dr. S. A. Mitchell, director of the Leander McCormick Observatory at the University of Virginia, announced that the distance of this mighty sun from the earth had been calculated to be 175 light years. With the measurements of the apparent diameter of Betelgeuse made about two years ago by Professor A. A. Michelson, of the University of Chicago, this makes possible the determination of the actual diameter of the star, which is found to be 242,000,000 miles.

A light year is the distance which light, traveling at a velocity of 186,000 miles in a second, traverses in a year. Light takes about eight minutes to come from the sun. The distance of Betelgeuse is so vast a number of miles that it is best understood by reducing the scale of measurement. If the distance of the sun from the earth be taken as one inch, making the diameter of our solar system across the orbit of Neptune, the outermost planet, some five feet and a half, then the great star in Orion would be 175 miles away.

On the same scale the sun would be a mere grain of dust one hundredth of an inch in diameter, while Betelgeuse would be somewhere between the sizes of a golf ball and a tennis ball.

The announcement of the distance of Betelgeuse as measured at the University of Virginia was part of an announcement by Dr. Mitchell of determinations of the distances of some 600 stars. The distance of the giant in Orion corresponds exactly with the average of observations previously made at the Mt. Wilson Observatory in California and at other noted observatories.

Measurement of the distances of the stars is made on exactly the same principle as is used by a surveyor to measure the distance across a river he can not cross, or by a range-finder to determine the distance of an enemy vessel at sea. Everybody knows that the same thing looked at from varying positions of view has a varying background. If a line be measured and the distant object viewed from the two ends of it and the angles which it makes with that "base line" accurately measured, the distance may easily be calculated by trigonometry.

That is the way the astronomers measure the distances of the stars. The only difficulty is getting a long enough base line. The biggest base line obtainable is the diameter of the earth's orbit, some 186,000,000 miles, but as against the vast distances of stellar space this is almost too minute to use as a measuring rod. The variation in the position of Betelgeuse at the extremes of this distance amounts to about as much as that of 21 inches seen at a distance of 4,000 miles. In the case of a star this angle is called the "parallax." These determinations are taken six months apart for each star since the earth is then at opposite sides of its orbit.

The work of the Leander McCormick Observatory under Dr. Mitchell's direction in measuring the distances of 600 stars is considered of great importance, as up till about 10 years ago the distances of not more than 100 were known with approximate accuracy. Distance measurements are essential to all determinations of a star's real diameter and motion through space and are of great value in determining the velocity and direction of the motion of our own sun, carrying with it the earth and its brother planets through the pathless abysses of space.

THE PILTDOWN MAN

Science Service

MAN may have evolved completely from apes in western Europe, according to conclusions as to the relationship of the teeth from the famous Piltdown jaw with those of ancient apes and early and modern men announced by Dr. Aleš Hrdlička, curator of anthropology of the United States National Museum. Thus a European instead of an Asiatic origin of the human race is indicated.

The fossilized jaw has been a subject of dispute among scientists since its discovery near Piltdown, England, in 1912. Some scientists have maintained that it belonged to a very early human being. So primitive and simian-like is it, however, that others have declared it to be that of a chimpanzee. Recently Dr. Hrdlička made a trip to Europe especially to examine the original fossil. He made careful measurements of the length and breadth of the crowns of the teeth of this ancient relic.

From a comparison of these measurements with the corresponding molars of a large number of European, American, Egyptian, Chinese, Lapp, Eskimo, Indian, Polynesian, Melanesian, Australian, negro and other modern peoples, he declared to-day that the only conclusion that appears justified is that the Piltdown teeth, primi-

tive as they are in some respects, are already human or close to human.

Comparison with the measurements of the teeth of a large number of cave men teeth shows closer connection with the earlier than with the modern types of human beings.

Generally speaking, the more recent the teeth, more particularly the first molars, the shorter they are, the length of the crown of the tooth from front to back appears to diminish with the progress of time, while the breadth remains about equal. The Piltdown teeth in breadth are ordinary human, but they are longer than those of either present day or early man.

After determining the human relationship of this "Dawn Man," as has been called, Dr. Hrdlička secured from the National Museum collection a large number of teeth of ten American and twelve European species of apes, including chimpanzees, orang outangs, gibbons and others.

He found that the Piltdown man did not connect with any of the living forms of anthropoid apes. In Bohnerz Alb, one of an extinct line of large western European apes known as *Dryopithecus rhenanus*, however, he found a striking similarity both in shape and size, although difference in detail, with the teeth of this early Piltdown man.

"The close relation of the Piltdown molars to some of the Miocene or early Pliocene human-like teeth of this fossil ape, while not conclusive alone," according to Dr. Hrdlička, "raises legitimately the query as to whether man may not have evolved altogether in western Europe."

The differences in the sizes of male and female were taken into consideration in the investigation. It was often necessary to use a magnifying glass and take a number of measurements of each tooth to insure the greatest accuracy in the results.

Dr. Hrdlička holds that the Piltdown jaw is much older than the skull found near it and to which it had been supposed to belong. He placed the Piltdown jaw as much older than the Heidelberg jaw or that of any other European cave man.

A POSSIBLE NEW KIND OF WATER

Science Service

A NEW kind of water, unknown in nature, may be created in the laboratory, Sir J. J. Thomson, discoverer of the electron and master of Trinity College, Cambridge, England, predicted in his recent lectures at the Franklin Institute before a selected group of about 300 leading American physicists and other scientists.

Water is made up of two atoms of hydrogen and one atom of oxygen, as every high school student knows. Professor Thomson and many others since his pioneer work on the composition of matter have been determining how those atoms are arranged. In recent years a theory of the structure of water has been worked out that allows the arrangement of the hydrogen atoms symmetrically in several ways. This is not entirely satisfactory because such an arrangement should make water non-polar in its action toward light, while in reality water lets light through it more easily in one way than another. Now Professor Thomson suggested that the atoms of ordinary water are in the form of a twisted cube giving only one possible symmetrical grouping of the hydrogen atoms. This arrangement theoretically would have properties that would fit the sort that we use and drink every day. The new or allotropic form of water would have the form of an ordinary cube. The new form and ordinary water would be related somewhat like diamond and ordinary black carbon, which are both carbon.

Professor Thomson believes that the new kind of water is perhaps experimentally realizable by the aid of a strong catalyst, or a substance that helps a chemical operation, but does not actually enter into it. If it is found he predicts that it will have a large amount of energy and low stability, and unlike ordinary water, it will conduct electricity fairly well.

THE HONDURAS SPOTTED TURKEY

Science Service

AN expedition of the United States Biological Survey is to penetrate Central America with the capture of live specimens of the beautiful Honduras spotted turkey as its objective. The result will be the first attempt ever made to domesticate this rare wild bird. Harry Malleis, of the Department of Agriculture, has left for Belize, British Honduras, equipped for the difficult task of bringing a number of these turkeys to the United States.

It is planned to place these birds on Sapelo Island, off the coast of Georgia, under conditions which it is believed will be favorable for their propagation. If they prove adaptable to this country, further steps will be taken to domesticate and introduce them.

It is stated that prediction as to the outcome of the experiments could not be made at this time. They pointed to a large number of birds and animals which had upset calculation in the past. The nightingale introduced into this country soon died out, while the English sparrow multiplied rapidly.

The Honduras or ocellated turkey, the range of which extends over only a limited section of

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

Yucatan, Honduras and Guatemala has been greatly admired for the brilliantly colored eye-like spots on its feathers and for its excellent meat. It is somewhat smaller than our domesticated turkey, but the taste is said to be similar. Although it is found in the region occupied by the Mayan, who had the oldest and most brilliant civilization on this continent, as far as is known it has never been domesticated.

The expedition will also secure a large number of curassow, a larger turkey-like bird with crested head. If practical, Mr. Malleis will visit Turneffe Island, off the coast of British Honduras, and collect specimens of the wild life there. Little is now known of the natural history of this island.

FIELD EXPEDITIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

Press Bulletin, American Museum of Natural History, New York City

TUESDAY, April 17, was a red letter day at the American Museum of Natural History, for it brought to the authorities of that institution most welcome news from two of its expeditions in far off lands. The first to make its appearance was a cable from the Faunthorpe Indian Expedition stating that with the cooperation of the Maharajah of Mysore, the leaders of this collecting party, Colonel Faunthorpe and Arthur Vernay, had been eminently successful in getting representative specimens of wild Indian elephants and had completed the Bison group for the Museum.

Later in the day, a cable arrived from Roy C. Andrews, the leader of the Third Asiatic Expedition, stating—"Granger returns safely with choice collection. Mongolian expedition leaves to-morrow." This news was gratifying in more ways than one. First, that Walter Granger, the intrepid collector of fossils, had come through the dangerous zones safely. Second, that he had, in spite of great difficulties, succeeded in bringing his collections with him, which, report had it, he would have to sacrifice after months of arduous work in order to get through alive; and, thirdly, that Andrews was on his third year's search in new fields for more finds.

The public generally assumes that museum collectors ride about in ease and comfort, picking up at random what may be interesting. It is probable that some collectors do, but as yet this happy way of finding rare specimens has not fallen to the lot of any of the Third Asiatic party. Mr. Andrews, in a letter written on St. Patrick's Day, writes of the poisoning of the Russian Minister of War at Urga, that fearing a rebellion among the natives, all of the Mongols have been disarmed; that while a number of people have been shot thus far, the disturbance has been mainly confined to the Urga region. He was also worried about Granger, as a big row had started in his vicinity, and as yet word had not been received from him. However, knowing how tactful and resourceful Granger is, he felt that he would come through all right, but would very likely have to abandon the results of his season's work.

This year the expedition hopes to have a good wireless receiving set, and in this way hear from the outside world the happenings of the day. To the many friends of Andrews, Granger and Pope, word that success has thus far attended all their work comes as welcome news, and the authorities of the museum, of *Asia Magazine* and the Asiatic Society, through whose cooperation the expedition was made possible, are practically assured of further new and interesting contributions to science and literature.

A POLLUTED WATER SUPPLY

ACCORDING to a statement issued by the New York State Department of Health, over one thousand people in an up-state community noted as a health resort have recently been made ill as the result of the action of the water board in temporarily changing the source of the public water supply without taking precautions to insure its safety or notifying the health officer. So far no cases of typhoid fever have been reported, but it will be remarkable if the community escapes an outbreak of this disease.

On account of a shortage in the regular source of water supply, the superintendent of the water works was instructed by the water commissioners to draw an emergency supply from a lake which is seriously polluted by sewage from a number of houses and by surface wash from a large area of the village. Only eight or nine days later did the local health officer learn what had been done and then only upon telephoning to the water board after his suspicions had been aroused by the large number of complaints of illness which were reaching him. Upon ascertaining the facts the health officer immediately telephoned to the State Department of Health and an engineer from the division of sanitation was at once dispatched to install an emergency chlorination apparatus which rendered safe the temporary use of the lake water.

In the course of installing the chlorination apparatus, the engineer had to descend into a well from which the water was being pumped. Because of a break in a connecting tube of the apparatus and the lack of ventilation, his face

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was burned with chlorine gas, but he succeeded in completing the installation. The State Department of Health has frequent occasion to loan its emergency chlorination apparatus for temporary local use in the protection of public water supplies, but this is the first accident of the kind which has occurred. While there is not the slightest danger of any possible adverse effect upon the sanitary quality of the water from such an accident, the occurrence disclosed the need of special protection to the engineers handling such apparatus under certain unusual conditions, and the department has decided to purchase a gas mask to meet this need.

Dr. Hermann M. Biggs, state commissioner of health, in making public the facts regarding this outbreak, emphasized the danger to the public health involved in any lack of cooperation between local water boards and local health officers. "Other communities," said Dr. Biggs, "should assure themselves at once that the officials in charge of their public water supplies make it a practice immediately to notify the local health officer of any change in the source of supply. If the water board in this case had promptly informed the health officer of its plans, the State Department of Health would have supplied the chlorination facilities immediately and much illness and serious danger to the community would have been avoided. The practice of treating public water supplies with chlorine is now practically universal, and in many instances it is vitally important to make use of this simple, inexpensive and harmless expedient for the protection of the public health. The water supplies of New York City and many other communities in this state are already safeguarded in this manner.

In order to minimize the danger of such occurrences in the future, the state commissioner of health has caused to be introduced in the legislature a bill making local health officers ex-officio members of local water boards, so that they may be fully informed of all conditions affecting the public water supply. Pending the enactment of such legislation, Commissioner Biggs requested the public health council, at its meeting on April 10, to amend the state sanitary code so as to require local water boards to report to the health authorities any proposed change in the source of supply.

ITEMS

Science Service

A LIGHTHOUSE of unrivaled altitude and power, embodying all the most modern devices to insure the farthest transmission of its rays, has been proposed as a memorial to Christopher Columbus by delegates from Santo Domingo to the Pan American Conference, according to advices which have been received by the Pan American Union. It would be built on Santo Domingo and paid for and supported by the twenty republics of the western hemisphere. The location is advocated by the Santo Domingans because that island was the site of the first Spanish city in the new world, founded by Columbus himself, who lies buried there. The light would be placed upon a sufficiently high elevation so that its rays might be seen by vessels traversing the principal routes from Europe to the Panama Canal. Plans already submitted call for a unique design, that of a lighthouse surmounting a globe 150 feet in diameter, the lantern itself to be 385 feet above the ground. As a final touch it is proposed that the light be of the flash type and that its particular flash be the word "Colon" spelled out in the Morse code, reminding all travelers by the great sea route of the western hemisphere of the name and fame of the discoverer of the continent.

AN astonishingly rapid migration of an empty, sealed bottle, cast overboard at sea, is reported by the United States Hydrographic Office. Enclosing nothing but a "bottle paper," on which directions for its return were printed in seven languages, the bottle was put overboard from the S. S. *West Isleta* in the Pacific Ocean about 100 miles off the Central American coast on the last day of the year 1920. The little wayfarer of the seas was picked up on Misool Island, northwest of New Guinea, just about 8,400 miles across the whole width of the Pacific, on January 23 of this year. That would give an average drift of about 11 miles a day, assuming the bottle to have taken the shortest line, to have made no stopovers along the strands of the alluring South Sea islands, and to have been picked up immediately on its arrival at Misool. This, the Hydrographic Office, knowing the habits of bottles and of the South Seas, considers improbable.

THE action of the transatlantic steamship companies in adopting the suggestions of the United State Hydrographic Office relative to the shifting of the usual summer steamer tracks to the south is shown to have been timely by the weekly ice charts of the Hydrographic Office. Many bergs are reported on the old westbound track from the north of Ireland and Scotland to New York and Boston. Only one is reported dangerously near present tracks.

RECENT investigation of textile workers in England has shown that artificial lighting reduces the efficiency of workers by eleven per cent. of its normal daylight value.

SCIENCE NEWS

THE CHEMICAL CLASSIFICATION OF THE STARS

Science Service

THE great Henry Draper Catalogue of stellar spectra will be extended to include thousands of faint stars, especially those along the central line of the milky way, according to an announcement made by the Harvard College Obervatory, which has carried on for more than twenty years the classification of the heavenly bodies on the basis of chemical constitution.

In the analysis and classification of a star the light is resolved by means of a stellar spectroscope, an instrument used in various forms, but in its simplest arrangement comprising a prism of glass mounted in front of a photographic telescope. Many different telescopes and prisms were used in collecting the photographs of stellar spectra used in the compilation of the Draper Catalogue. The work was made possible through gifts by Dr. and Mrs. Henry Draper, of New York.

When the light of stars is analyzed with the spectroscope they are found to differ very greatly from each other. For the hottest stars the elements hydrogen and helium predominate in the radioactive layers of the stellar atmospheres. For the stars of intermediate temperatures, such as the sun, the metallic elements like iron, nickel, calcium and sodium are indicated in the hot vapors; and for the cooler and redder stars chemical compounds appear. The Harvard classification, which is universally used by astronomers, recognizes more than thirty types.

For the southern stars in the Draper Catalogue the photographs were made at Arequipa, Peru. The high altitude of that station made it possible to photograph much fainter stars than an instrument of equal power could photograph at the central station of the observatory in Cambridge. As a consequence, the northern stars are less completely known than those south of the celestial equator and improved photographs of these northern regions are now being made for the extension of the great catalogue.

Since a very large majority of the fainter stars is concentrated into that band of light know as the Milky Way, the Harvard observers will confine their future classification work largely to the regions along the central line of the Milky Way. It is announced that some of the new photographs will permit the classification of five to ten times as many stars as could be included from the early photographs.

The original catalogue is in constant use at all observatories. It is published in the *Annals* of the Harvard College Observatory in nine large quarto volumes, the last two of which are being printed this year. The entire catalogue gives the chemical classification of nearly a quarter of a million stars.

The extension of this analysis of the stars will include not only a record of the type of spectrum and the position of the stars, but also a new determination of their brightness. It is found that the labor of determining accurately the brightness of these faint Milky Way stars is greater than that of their classification into spectral types and will involve the making of hundreds of photographs with the Harvard telescopes. The work of extension is being undertaken under the direction of Professor Harlow Shapley, director of the Harvard Observatory, and the classification of the spectra will be made, as previously for the main catalogue, by Miss Annie J. Cannon.

A NEW RADIO ALPHABET

Science Service

A NEW method of transmitting a new radio telegraph alphabet that will eliminate interference and double the speed of sending was proposed by Major General George O. Squier, chief signal officer of the United States Army, in an address before the National Academy of Sciences.

The system, briefly, depends upon a difference in amplitude of current vibrations, instead of upon a difference in length of the vibrations, to distinguish between the dots and dashes of the code. Universal use of the new system will practically eliminate interference from radio telegraph stations.

"Due to the rapid expansion of the use of radio telephony and telegraphy, the problem of interference, both natural and artificial, is becoming each day more and more pressing for solution. The conservation of the ether lanes is suddenly rising to international importance. In addition, the daily growing use of radio for the solution of auxiliary problems such as range finding and navigation, further serves to complicate the problem. It may be said, therefore, that the fundamental problem for the radio engineer is to devise methods to utilize these limited channels to the greatest possible extent and to bend his efforts to the extension of their limits both high and low.

In the case of artificial disturbances the

chief offender, from an engineering standpoint, is the radio telegraph practice as it is universally conducted at present. It is impossible to tune out the high power radio telegraph stations, especially when in close proximity. They produce a veritable eruption in the ether, creating disturbance over a wide range of frequencies and these serve to interfere with any form of radio receiver yet devised.

Signals are universally emitted from the transmitting antenna in the form of sudden interruptions in the antenna circuit or sudden variations in this current. This produces about the worst possible source of disturbances in the ether for the reason that the disturbance has no regularity of any kind and the speed of operating the sending key has a marked influence on the whole phenomena. Present practice is drifting away from complete interruption of the antenna current, but the present methods of irregular variations of the current are still a long way from scientific solution.

Static or atmospherics will also be eliminated by the new method, General Squier believes, since these natural disturbances have higher frequencies than the low modulating frequencies that are employed by the new method.

The new system developed from one originally planned as an improved method of sending through the submarine cables. This is a continuous wave system developed by means of an unbroken alternating current. It abandoned the Morse principle of different lengths of time for the signals and adopted the plan that all individual signal units should occupy equal lengths of time and have equal importance, whether they were dots, dashes or spaces. They are distinguished by varying the intensity or amplitude of current.

Great speed can be obtained by the use of the new method and the printing telegraph, as General Squier pointed out, that a modulating frequency of sixty cycles per second, the usual alternating current power frequency corresponds to a speed of 450 words a minute of five letters each, although these may prove to be too high for traffic reasons.

At present the radio engineer has utilized and made his own all the audio frequency range and at least several octaves of the radio frequency range and has devised apparatus for the amplification and rectification of both of these ranges, audio and radio. This plan proposes to enter the unused infra-audio range, which would not only add a most useful band of frequencies to those now used, but would give a band below the range of the human ear. If this band were employed for telegraphy, an additional advantage would be that it could not interfere with any radio receiving. This method of eliminating interference is the most effective.

Finally, it is seen that by the method proposed here it is possible to modulate a single radio frequency by a number of modulating frequencies and thus multiply the capacity of each radio channel.

HEREDITARY IMMUNITY TO DISEASE

Science Service

THAT artificially induced resistance to infection may be transmitted to later generations is the conclusion reached by Professor M. F. Guyer, of the University of Wisconsin, after years of experimentation on animals at the University of Wisconsin. Professor Guyer, speaking before the American Philosophical Society about his latest investigations on the question of the inheritance of acquired characteristics, stated that inoculating successive generations of rabbits with the germs of typhoid fever he was able to develop in their blood an anti-body which is transmitted from mother to offspring and renders them more immune to the disease. Rabbits of the fourth or fifth generation so treated may be made capable of overcoming an injection of thirty to forty times as many typhoid bacilli as the original rabbits could stand. Whether such acquired immunity is also transmissible through the paternal side has not yet been determined but as Professor Guyer says: It is of interest to learn that young may not only acquire immunity reactions from their mothers but may retain them sufficiently to transmit them in a measurable degree, without further immunization, to their offspring. Even if this is nothing more than maternal transmission it may be of practical importance since a large percentage of a population might in time through such transmission come to exhibit some degree of immunity to a widely prevalent disease. If the results of our future experiments bear out our present data it becomes evident that when succeeding generations of rabbits are immunized to typhoid bacilli some modification is made in the immunity mechanism whereby individuals of later generations are capable of developing higher resistance against these germs than were the individuals of the first generation treated.

If Professor Guyer's results are confirmed by further experimentation, they will throw a new light on the mechanism of heredity and the mode of evolution. They may explain how certain races have acquired immunity to diseases fatal to others; for instance, why measles, which is with us a mild infantile malady, has almost wiped out the adult population of some Pacific islands

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

when the disease was introduced there. Professor Guyer has proved in previous experiments that an eye defect, artificially induced in a rabbit, may be passed down to the ninth generation and probably becomes permanently hereditary. His researches are generally regarded as having dealt a death-blow to the theory formerly held, that acquired characteristics are never inherited.

WEATHER FORECASTS FROM SHIPS

U. S. Department of Agriculture Press Service

A NEW development in weather forecasting in which the Weather Bureau, United States Department of Agriculture, is much interested is the possibility of making forecasts from aboard vessels in the North Atlantic ocean. E. H. Bowie, chief forecaster of the Weather Bureau, who returned last week from a cruise on the French training ship, *Jacques Cartier*, is convinced that it is entirely practicable to forecast winds, weather and storms at sea. During the voyage to and from France, the *Jacques Cartier* received broadcasts of meteorological observations twice a day from Europe and America, and many vessels within range forwarded by radio their observations of the barometric pressure, temperature, wind, weather and state of the ocean. From these observations, both on land and on sea, weather charts were constructed twice each day, and from them forecasts of wind, weather and storms were prepared and broadcast to all ships.

The weather charts constructed on board the vessel were even more comprehensive than those constructed in Washington, for the reason that meteorological observations from the sea were available. Forecaster Bowie states that forecasting at sea is simpler than forecasting on land areas because diversified topography does not have to be taken into consideration in its effect on winds, weather and the movement of cyclones and anticyclones, which move with more regularity on the sea.

A weather and storm forecast service on the North Atlantic would benefit shipping and make it possible to retransmit sea observations to the meteorological services on land, so as to more accurately forecast the wind, temperature and weather conditions along the eastern shores of the United States and over western Europe.

STORAGE OF BITUMINOUS COAL

Bulletin of the Bureau of Mines

SAFE storage of bituminous coal is probably the only solution of the problem of stabilizing the coal industry, according to investigators of the United States Bureau of Mines and the Carnegie Institute of Technology, who have just completed a study of the spontaneous combustion of soft coal. As long as the peaks of demand react back to the miners, the coal industry will be a seasonal one, with a resultant unsatisfactory labor situation, states Joseph D. Davis, fuel chemist, and John F. Byrne, research fellow, who conducted the investigation. If some system could be devised whereby coal could be stored economically, with little deterioration and danger of spontaneous combustion, the mines would be operated practically the whole year—say, 300 working days instead of 180 to 270 days, as in 1920—at a uniform rate of production. Unfortunately no such general storage system has yet been devised.

The loss by deterioration of coal at ordinary temperatures is small when compared with that caused by rapid oxidation at elevated temperatures and the loss by spontaneous ignition. To overcome the hazards of self-heating and spontaneous combustion, various means of storage have been suggested, such as storing under water or in an atmosphere of carbon dioxide; screening the coal and storing only large sizes; cooling the coal pile by means of ventilating pipes; covering the coal pile with sand or with a layer of fine coal to prevent breathing of the heap, and so forth. Many of these methods do more harm than good, and others are prohibitive on account of their cost.

The tendency of coals to fire spontaneously differs with their age—the younger coals being the most dangerous. No case has been recorded in which anthracite coal fired spontaneously—even fines and slack storing safely. At the other extreme is lignite, which can not be stored, even in lumps, with safety, except under water. Between these two extremes are the various grades of bituminous coals, the class which is most commonly stored. The liability of different bituminous coals to fire varies widely on account of differences in the coal; but, broadly speaking, the bituminous coals of the eastern part of the United States store better than the coals of the middle west. These, in turn, are safer to store than the sub-bituminous coals of the intermountain region. While the tendency to fire will vary widely in any one class of coal, generally speaking, the higher the rank the less the danger of fire and the less the deterioration in storage. The classification as to self-heating coincides with the classification of coals, beginning with lignite as the most dangerous, ranging through sub-bituminous, bituminous, semi-bituminous, and anthacite as the least prone to spontaneous combustion.

The solution of the problem of spontaneous

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combustion may lie in the microscopic examination of coals and its correlation with the rate of heating. Coal is composed of three parts, namely, anthraxylon, or bright coal, attritus, or dull coal, and mineral charcoal, and may be separated into almost pure samples of each. These three constituents differ in their ease of oxidation and rate of heating. Tests indciate that the anthraxylon is the constituent that heats first in the spontaneous heating of coal.

As the results of the experiments of Messrs. Davis and Byrne, it is stated that the presence of fines in a coal pile should be avoided. Coal should be handled as little as possible and should be screened wherever practicable before storing. Coal coarser than 1/4-inch showed no rapid self-heating throughout the experiments.

The experiments show that with the same coal, moist air will give a lower "critical" or spontaneous combustion temperature than dry air. Therefore, wetting the coal pile to retard heating is not good practice unless the coal is completely immersed.

Instead of hastening spontaneous combustion, partly oxidized coal seems to act as a deterrent when mixed with fresh coal. It appears that the danger in mixing two grades of coal, or in storing coal on the same pile at different times, arises from physical rather than chemical causes. If no heating has occurred at the surface of the heap, it is safe to pile more coal on top, provided there is no accumulation of fines at the contact of the new and old coal. A mixture of two kinds of coal will heat more rapidly than the poorer of the two.

Artificial mixtures of coal and pyrite in various proportions showed a critical temperature no lower than that of the coal alone, while pure pyrites had a critical temperature 26°C. higher than the coal. From this it appears that massive pyrite or "brass lumps" are not dangerous in a coal pile.

On account of the low conductivity of coal, cooling by artificial ventilation is almost impossible unless the air reaches every part of the pile. Generally the air travels through the stack in currents, and exerts no cooling effects on parts a short distance away from its channels. Exclusion of air as much as possible, in order to stop oxidation, is more successful than attempts at ventilation to dissipate the heat generated.

Coals, under various physical and chemical conditions, have been tested to determine the temperature at which they generate heat so rapidly that, provided no deterrent is applied, the coal will eventually ignite. This temperature has been arbitrarily called the "critical temperature." Under similar conditions of heating and aerating, this critical temperature is an index of the liability of a coal to fire spontaneously. The "critical temperature" method of testing coal may be applied to the various coals of the country for grading their relative tendencies to fire spontaneously, and the Bureau of Mines expects to develop this method further and apply it in a survey of the coals of the United States.

ITEMS

Science Service

MANY so-called West Indian hurricanes really originate in the neighborhood of the Cape Verde Islands 1,000 miles or more to the eastward, according to Charles L. Mitchell, meteorologist of the United States Weather Bureau, who spoke before a meeting of the American Meteorological Society in Washington on April 17. None ever originate in the eastern third of the Caribbean Sea, he asserted. Those formerly supposed to have this place of origin really started far to the eastward. The hurricane season is generally considered to be the months from June to November inclusive, but the month of August and the first half of September was the time when the most of such storms of Cape Verde Island origin were found. Many of these curved to the northward before reaching the Lesser Antilles, while others continued across the Caribbean or the Gulf of Mexico. Other hurricanes were found to originate either in the western Carribean or the Gulf of Mexico.

USE of the surplus explosives of the government left over from wartime, as aids in the study of earthquakes was suggested by Professor R. A. Daly of Harvard University to the American Geophysical Union at their recent meeting in Washington. The idea is to cause miniature earthquakes, the details of which would be known. From a study of them more would be learned about the big earthquakes. Professor Daly suggested that the explosives be set off in abandoned and worked out mines and the rate of the vibrations through the different layers of the earth's crust studied. It is known that earthquake waves travel at differing rates in the different strata but accurate measurement of these rates and differences are difficult in the case of natural earthquakes since it is seldom known accurately just when one occurs at the place of its origin, nor how deep is its beginning.

MORE than eighty-five per cent. of the corn raised in this country is fed to live stock and less than ten per cent. is used directly for human food.

SCIENCE NEWS

THE INCREASING LENGTH OF LIFE

Science Service

TEN years can be added to the life span now prailing in the United States, according to Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Company, who cited figures which indicate the possibility of this increase in average life expectancy of Americans without any new discoveries in medical science or without any attempt to get "Back to Methuselah" by the Shavian, Ponce de Leon or monkey-gland routes.

There is great diversity in the span of life in various countries, he pointed out, ranging from the complete life expectation at birth of 61.8 years for females in New Zealand to 22.6 years for males in India. In the United States it is 54 years for males. In the light of social and economic conditions it is easy to see why these differences occur.

The substantial increase in the life expectation which has occurred in the last century is the best indication we have of the improved material progress of the great mass of people in the civilized countries of the world, he said. Figures for England and Wales show a gain in seven decades of twelve and a half years, while for Sweden, for which there is the best historical data on the Continent, there has been a gain of fourteen and a quarter years in eight decades. In our own country, for the state of Massachusetts, which has the oldest tables of any value, there has been a gain in the life span of fifteen years in sixty-five calendar years.

"In England at the time of the first table, only 29.5 per cent. of the male and 32.4 per cent. of the female population attained age 65, whereas at the time of the last table 43.5 per cent. of the males and 51.2 per cent of the females attained this age," said Dr. Dublin. "In New Zealand, where the best longevity conditions prevail, 55.9 per cent. of males and 60.5 per cent. of females reached the age of 65 in the period 1906 to 1910. As this is the age which closes the active working period of life, it must be obvious that that nation is most productive, and its people enjoy the largest measures of longevity, and shall I add prosperity, which can bring the largest proportion of its people up to the threshold of old age."

The total life expectancy at birth in the United States is now only 55 years. This could be raised to 65 years. The mortality from birth to five years could be reduced by approximately two thirds, the mortality from five to ten by two thirds to one half; from 10 to 60 years by one half; from 60 to 70 years by one half to no reduction.

Fifteen per cent. of all the deaths that occur each year are of children within the first year of age. This infant mortality cuts very heavily into the life expectation, but is relatively easy to prevent and control.

"For instance, we have assumed a mortality rate of 4.2 per 1,000 for the third year of life, and this figure is only 20 per cent. below the rate prevailing in New Zealand nearly fifteen years ago. In the third year of life virtually two thirds of the entire mortality is due to such infections as typhoid fever, diarrhea and enteritis, the four communicable diseases of childhood, measles, scarlet fever, whooping cough and diphtheria—tuberculosis and respiratory diseases. Who will deny that these conditions are within control if we mean to control them?"

To achieve a reduction by half of the mortality between the ages of ten and sixty, it is only necessary to reach about a 20 per cent. reduction of the mortality for these ages in New Zealand in recent years. Such a goal is very nearly attained by the best life insurance companies in their ordinary experience, with possibilities of a further curtailment of mortality among insured persons.

The prevention of occupational mortality has scarcely been begun as a nation-wide effort. Dr. Dublin states that there can be no question that certain industrial processes widely developed throughout the country seriously shorten the life span. The effects of poisonous fumes, of deleterious dusts and actual contact with poisonous substances, and unduly long hours of labor, all result in raising the rate, while occupational accidents alone are responsible for as much as fifteen thousand deaths, for the most part of men in their prime.

GAPS IN SATURN'S RINGS

Science Service

THE remarkable gap that divides the ring of Saturn into two main parts is once more the subject of an attempted explanation, this time by the English mathematician Goldsbrough; but a second scientist steps forward immediately to prove that the new theory is wrong. Mr. W. M. H. Greaves, of Cambridge, England, in two papers presented to the Royal Astronomical Society of London, contends that Dr. Goldsbrough

has not satisfactorily accounted for the division in Saturn's ring.

The halo that surrounds the planet Saturn is not duplicated anywhere in the solar system, nor in any other system as far as we know. It was considered at first to be a disc or plate, until closer observation revealed it as an extremely thin ring encircling but not in contact with the planet. In 1675 the Italian astronomer Cassini discovered that what had appeared as one broad ring was in reality two, separated by a narrow dark band. The dark band has since been known as Cassini's division.

Whether this dark band is totally devoid of matter, or whether it is merely a space in which the shining material of the rings is not so dense, has long been the subject of controversy. Moreover, up to the present time no one has found a really acceptable explanation as to why this gap or division in the ring should exist.

Saturn is the second largest of the eight planets in the solar system. It is nearly one hundred times as massive as the earth, and its diameter is nearly ten times the earth's diameter. Its day is only ten hours and fourteen minutes long, but its year is equal to 29½ of our years. In addition to its ring system Saturn has ten moons. The planet itself, like Jupiter, is gaseous, and there are wavy, cloudlike streaks marking its surface. Once in a while a definite marking or spot, similar to a sun-spot, appears, giving the terrestrial observer a chance to determine how fast the planet turns on its axis.

Saturn's ring system, however, is of greatest interest, because it is a unique occurrence. When we see Saturn in different parts of its orbit the rings are seen in various phases, sometimes edge-on, sometimes partially broadside. When seen edge-on they are almost invisible, appearing as a narrow streak, which proves them to be extremely thin. When they turn their greatest surface toward the earth they increase Saturn's brightness more than two-fold. The rings are not gaseous like Saturn itself; they are composed of numberless small solid dust particles, each one revolving about the major planet as a separate moon. They do not shine with light of their own, but merely reflect the light that falls on them from the sun.

Besides the conspicuous gap discovered by Cassini, which divides the inner from the outer ring, additional dark streaks or divisions have been found on the bright surface of the rings. These as well as the larger gap are thought by astronomers to be regions where the dust particles composing the rings are for some reason thinned out or entirely absent.

Dr. Goldsbrough, in a paper presented to the Royal Society last year, offered a theory to account for the large gap in Saturn's ring. But Mr. Greaves objects to Dr. Goldsbrough's solution, saying it is a mere first approximation which would not hold if followed to the conclusion; Greaves proposes a preliminary theory of his own which attributes the gaps to the disturbing gravitational effects of Mimas, the innermost of Saturn's moons. Mr. Greaves' theory has as yet been neither accepted nor rejected by astronomers.

REVIVAL BY ADRENALIN

Science Service

ADRENALIN, the drug which is reputed to have "brought back the dead to life," is a life-saver rather than a life restorer. It can stimulate a heart suddenly overcome by some accidental shock or strain, but it can not renew a physical frame exhausted and poisoned by long disease. Such is the official opinion of the *Journal* of the American Medical Association as expressed in an editorial.

The power of the suprarenal glands, of which adrenalin is the extract, to raise blood pressure by causing powerful contraction of the muscular walls of the blood vessels has been known for many years. The glands are small, two in number, and situated just above the kidneys. Their active principle, causing stimulation of the muscles of the heart and blood vessels, was isolated in the period from 1901 to 1903 by several chemists, and called adrenalin.

Recent publicity given to its use in reviving persons apparently dead has recalled attention to earlier reports of a similar nature. After several cases had been reported, two German scientists in 1910 experimented with dogs whose hearts had ceased to beat after the blood vessels leading from the organ had been tied. They found that when adrenalin was injected directly into the heart there was a strong contraction of its muscles and a rapid rise of the blood pressure, but if the injection were delayed until all the body functions had apparently stopped and until massage of the heart and forced breathing of oxygen were without effect, the results were less satisfactory.

During the war a German surgeon injected adrenalin into the hearts of three desperately wounded soldiers. Improvement was only temporary, the men subsequently dying of their wounds. Experiments continued after the war and in 1919 there was a report of forty-five cases in fifteen of which adrenalin had revived the patient from an apparently hopeless condition, but in no case did the patient survive longer than eight hours.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

Two years ago a German surgeon reported the reviving by means of the drug of a woman who had "collapsed" while being operated upon and was so far gone that even direct massage of the heart through the operation wound failed to start it going again. Six minutes had elapsed when the drug was injected. Improvement in the heart sounds was noticed in ten seconds, breathing was soon resumed and four weeks later the woman was discharged as cured.

A case fully as remarkable was described in March of this year by Dr. Carl Bodon, attending physician at the American legation at Budapest. He was called to treat a man, 56 years old, apparently dying of a heart attack. While the doctor was applying the usual strong remedies the patient seemed to die, lying relaxed and with even his lips of a death-like pallor and with his heart action and breathing apparently ended. The drug was immediately injected into the heart. In forty-five seconds the heart beat was again audible to the stethoscope, breathing began and two hours later consciousness was restored. Three months later the man seemed entirely well.

As a result of these cases and ninety others reported by Dr. Bodon the virtues and limitations of the new treatment are apparent. It is not to be used in hopeless cases as death from cancer or tuberculosis, where the whole body is poisoned by the disease. It is to be used when the heart stops during an operation as the result of shock or because of abnormal sensitiveness to some drug, or generally "in every case where we know the patient could have lived if the fatal state had not developed."

The *Journal* concludes: "It must be remembered that cases when such restoration can be utilized are rare indeed. When death comes as the result of the wearing away of tissues, as the result of toxic action by overwhelming doses of either bacterial or metallic poisons, as the result of destruction of masses of vital organs, it would be cruel and futile to arouse false hopes by what could only be a sensational experiment. Adrenalin will cause contractions in a heart even after it has been removed from the body in which it rested; but that is a far different matter than the restoration of life when that intangible thing known as the spirit has passed away."

THE COTTON BOLL WEEVIL TO BE ALLURED BY SMELL

Science Service

AN attempt to attack the conquering cotton boll-weevil by more subtle means than have hitherto been employed is about to be started by the Department of Agriculture. Such crude methods as gassing and poisoning having been ineffective the insect is going to be allured to his doom through his sense of smell. At least such is the hope of the department experts.

A research is about to be begun to find out if there be any particular odor or emanation from the cotton plant which attracts the weevil. If such is found, it will be studied until the chemical substances which cause its action are isolated. It is hoped these may then be made synthetically and used to lure the pest of the cotton fields from the cotton to poisoned baits or else to cause him to raise a family before the cotton is developed enough to furnish them with the proper means of support.

The weevil is known to be attracted to the cotton plant at two distinct stages of its life and of his own. The first stage is before the buds have formed. The weevil then frequents the plant but does relatively little damage, eating only the leaves. It is later, when the buds or "squares" form that his deadly work is done. Deadly for the cotton plant, but life-giving for the weevil or for his species. It is then that the insect lays the eggs in the unformed boll and it is about this process that the scientists have made a promising discovery.

If the eggs are laid before the cotton plant has reached a definite stage of maturity they are sterile. In other words, the buds contain some substance which when eaten by the weevil is absolutely essential to the fertility of the eggs. This substance is apparently not present in the plant until a certain stage of its growth and it is this potent material which the chemists also hope to discover.

If they discover that and if the substance which attracts the weevil to the cotton in the first place can be identified, the life of the weevil is going to be beset with perils. For it is then planned to make the first chemical synthetically and to use it to attract the pest to poisoned bait, or in the more subtle manner, it will be combined with the second so that the insect will become sexually mature before the cotton is ready to support his new family. The eggs will be laid and the little weevils hatched as larvae, but instead of finding themselves inside a nice juicy young cotton boll, they will emerge on a cold and famine-stricken world and, lacking the means to subsist, will perish.

Such is the plan of campaign mapped out by experts of the Department of Agriculture. The first step is to find what the substances are which attract the weevil and cause its eggs to become fertile. This work has been given to Dr. F. B. Power, of the bureau of chemistry, isolator of

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GLANDS CAUSING PREMATURE AGE

Science Service

GLANDS which cause premature age rather than prolonged youth have been used by Dr. W. M. Swingle, of Yale University, to turn tadpoles into frogs. This process, which in the case of the bullfrog, nature does not complete inside of a year, has been accomplished by Dr. Swingle, using the gland treatment, in about two weeks. The thyroid glands of adult frogs were grafted into bullfrog tadpoles to make them hustle into premature froghood.

Thyroid gland substance is known to have some mysterious effect upon development and when the gland is unnaturally small at birth, or its function is impaired, a child's physical and mental growth is so stunted that it becomes a deformed idiot.

In some cases reported by other investigators where bits of the thyroid gland were fed, the development was more rapid than the growth of the tadpole, so that frogs apparently adult but no bigger than flies were obtained.

Tadpoles deprived of their thyroid and pituitary glands ordinarily were found by Dr. Swingle not to transform into frogs; they remained tadpoles long after normal tadpoles had metamorphosed. However, if these tadpoles without their glands are fed on thyroid or substances containing much iodine they can be made to transform. Some food containing iodine is necessary if tadpoles complete their life cycle. Without iodine they remain in the infantile stage.

ITEMS

Science Service

THE value of a smoke barrage against the assaults of Jack Frost on budding orchards and tender vegetables is being tested at the Edgewater Arsenal under the supervision of Weather Bureau experts. The smoke screens are being supplied by the Chemical Warfare Service. The use of orchard heaters to prevent frost has long been of wide application in the commercial orchards of the far west. It has been suggested that part of the effect of these heaters comes from the smoke given off, which acts as a sort of blanket to prevent radiation from the ground and the foliage and so keeps up the temperature above the frost level. The smoke screens at Edgewood are emitted without material amounts of heat from chemicals such as were used for that purpose in the war. Thermometers are set up in parts of an open field that is kept covered with smoke on clear nights when the conditions are similar to those prevailing when frost occurs. Another part of the field is left clear, but also provided with thermometers and the lowest temperatures reached in each section are recorded. If the tests show the smoke to have any important effect in keeping the temperature up, they will open the way to a wide application of some of the by-products of the war. Professor H. H. Kimball of the Weather Bureau is in charge of the investigation.

A CONCESSION to make use for power purposes of the hot steam and gases emitted by the Tatio volcano has been granted to Sr. Luis Torti, the Pan American Union has been informed. The volcano is located in the Canton of Sud Lipez, near the Chilean frontier. According to Sr. Torti, about 50,000 horsepower should be available as the vapor contains very little carbonic acid and can be immediately transported to the turbines. This quantity of power is estimated to suffice to electrify all the Bolivian railroads and to furnish power for the principal mining companies in Sud Lipez. A similar concession to a stock company has been granted in Antofogasta, Chile, to use the vapors on the Chilean side of the volcano.

ACETYLENE, the gas used in bicycle lamps and home gas plants, has been used by physicians in Freiburg, Germany, as an anesthetic with much the same results as have been secured with ethylene, the new anesthetic developed at the University of Chicago, according to information reaching here. The acetylene, which is usually made by letting water come in contact with calcium carbide, is mixed with oxygen before administration to the patient who is to undergo an operation. Ethylene and acetylene are very similar chemically as the molecule of the latter is made up of two atoms of carbon and two more hydrogen atoms.

THE British government has purchased the ship used by Captain Scott on his South Polar trip of 1901 for a scientific expedition to trace the migration, numbers and rate of reproduction of whales in the Antarctic.

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Each class is limited to 75 students, men and women being admitted on the same terms. **Except in unusual circumstances, applications for admission will not be considered after July 1st.**

If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School,
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SUMMER WORK FOR GRADUATES IN MEDICINE

Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

THE SOLAR ECLIPSE OF SEPTEMBER 10

Science Service

AT two temporary stations and the main observatory, the scientific men of the Mount Wilson Observatory of the Carnegie Institution of Washington will observe the total solar eclipse on September 10, Dr. Walter S. Adams, acting director, said in response to an inquiry by Science Service.

One expedition will be located well within the path of totality, probably at the Military Reservation at Point Loma, near San Diego, California.

The other expedition will be at the edge of the shadow at some point east of San Diego. The observations here will consist mainly of photographs of the sun's atmosphere or so-called chromosphere with spectroscopes of various types. When the moon just covers the sun, the observer, looking at the sun's edge through a spectroscope, sees a vast number of bright spectral lines flash into view. These are produced by the gases which constitute the solar atmosphere and form what is termed the "flash" spectrum. The study of their intensities, the level to which they rise and their exact positions forms one of the most important investigations made at eclipses.

At the central station within the path of totality the observations will cover a wider range. These will include direct photographs of the corona, as the sun's outer atmosphere is called, and of the field of stars in the vicinity of the sun, the latter to be used for determinations of the bending of the rays of light near the sun's edge as predicted by Einstein's theory of relativity. Measurements will be attempted with a delicate thermo-couple of the amount of heat radiated by the corona, and its spectrum will be investigated with several different instruments, including an interferometer. Observations will also be made of the "flash" spectrum, and the attempt will be made to determine the position (wave-length) of some of the bright lines with a high degree of accuracy.

The observatory now has under construction a fifty-foot interferometer intended primarily for the measurement of the diameters of stars. It is hoped that the central section of the large steel beam will be completed in time for use at the eclipse. It will consist of a structural steel framework eighteen feet long, four and one half feet wide and ten feet deep, mounted upon a pier and driven by clockwork. To this can be attached several of the instruments to which reference has been made, and the whole apparatus can be pointed directly at the sun, thus obviating the use of reflecting devices. In addition, a portion of the Snow telescope will be used at the central station, and a smaller reflecting telescope for the station at the edge of the path of totality.

About 98.5 per cent. of the sun's disk will be obscured at Mount Wilson, and it is probable that certain valuable observations can be made with the powerful equipment which is there available.

Assistance to foreign astronomical expeditions coming to Mexico to observe the total eclipse of the sun on September 10 will be given by the Astronomical Observatory of Tacubaya. Dr. Joaquin Gallo, director of the observatory, has secured from the Mexican Meteorological Service data as to what parts of the path of the total phase are most likely to be free from clouds at the time of the eclipse.

From these data it is concluded that one of the best locations is the region of Cuencame in the state of Durango, where little rain falls in September. The region of Berrendo in San Luis Potosi and Matehuala presents also a minimum of cloudiness, although on many days which are cloudless the sky is hazy. Coastal regions on the Gulf of California and on the Yucatan peninsula experience excessive cloudiness. The part of the path of totality lying in the western Sierra Madre mountains suffers from lack of easy communication.

The Tacubaya Observatory hopes to be able to send two expeditions into the path of the total eclipse with the twofold object of making observations and of being of assistance to foreign expeditions there for that purpose. Six expeditions from North America are expected and it is possible there may be one from France, one from England and two from Spain. Passes will be granted for the free entry into the country of the scientific instruments, as well as a discount on railway freight rates on materials used by the foreign expeditions.

The observatory hopes to be able to take a series of motion pictures of the eclipse, to be used for instruction and study. A diffraction grating will be used for a study of the spectrum of the solar corona, and an artist will accompany the expedition to paint a faithful reproduction of the spectacle.

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THE MEDICAL DEAN

The University of Chicago Chicago, Illinois

THE GULF STREAM AND THE WEATHER

Science Service

VARIATIONS in the temperature of the Gulf Stream are advanced by Dr. C. F. Brooks, professor of meteorology at Clark University, as a probable cause of the extraordinary weather reported during the past six months from both sides of the Atlantic Ocean. The subject first received attention at the meeting of the National Academy of Sciences in Washington last month when Dr. C. G. Abbot, of the Smithsonian Institution, announced a recent fall in the heat of the sun of some three or four per cent.

A summary of freaky weather conditions recounted by Dr. Brooks includes an extraordinary amount of ice in the western North Atlantic, a very early spring in northwestern Europe, an equally tardy one in eastern America, and unusually cold, rainy weather over northern Africa.

These conditions seem to have resulted, he says, from the presence of a large area of warm ocean water in the eastern Atlantic, causing expansion of the warm, moist air, southwest winds over western Europe, northwest winds over eastern America, and northeast winds over northern Africa, a combination which would result in conditions observed the past six months.

The more remote cause is probably variations in the temperature of the Gulf Stream. Dr. Brooks states that "four to six months after a period of strong northeast trade winds in the eastern Atlantic a body of water warmer than normal is usually found passing through the Florida Straits and flowing northeastwards, while from the eighth to the eleventh month cooler water follows. The warm water heats and supplies the air over it with an abundance of moisture, thereby expanding the air and favoring low pressure. This in turn not only makes muggy, showery weather when winds are on shore, but also tends to draw heavy air in unusual amounts out of the cold north and northeast, thereby creating storms. Later the cooler water makes the air less humid and favors quiet weather with general mild, southerly winds. It will be of exceptional interest to watch for such weather evidences of a warm Gulf Stream from May to July or August, followed by a cooler one from September or October through to February. Already the heavy rainfall of northern and semi-arid northeastern Brazil in February may have been a manifestation of an advancing area of unusually warm water in the equatorial current, which feeds the Gulf Stream."

Among the freaks of the weather listed by Dr. Brooks are the warm spring in England which caused the appearance of spring flowers there in February; heavy rains in the northern Sahara desert, so that stream beds at Biskra that have been empty three years were reported full; and wide variations in the snowfall in the United States with heavy falls in May in many sections.

THE PERIODICAL CICADAS

Science Service

THIS is a seventeen-year-locust year. In fifteen states east of the Mississippi River these remarkable insects, more properly known as the periodical cicadas, will emerge from the underground homes which they have inhabited for seventeen years, and the males will fill the woods with their shrill love songs. The females are dumb. The first cicadas may be expected to appear above ground within a week.

The states in which they will be heard and seen this year are Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. Not all parts of the states mentioned will be affected, the distribution of the cicadas being decidedly local in character.

Periodical cicadas appear somewhere within the range of their general distribution nearly every year. This is in agreement, however, with their periodical character as it has been found that they all belong to swarms which regularly reappear at intervals of thirteen or seventeen years. More than one swarm may inhabit a given locality, causing an apparent return of the insects at less regular intervals. This year's swarm is of the true seventeen-year variety.

It is probably the second largest of all the swarms and one of the most widely distributed. It has also historic interest in that it is the identical swarm which was first observed by Europeans in America. Colonies of the insects around Massachusetts Bay attracted the attention of the early white settlers in 1634 and mention of their appearance is to be found in books published some time later. Their direct descendants in the seventeenth generation will be heard near Plymouth and at Barnstable within a few days.

Periodical cicadas are growing less numerous in many localities owing to the cutting down of the forests. The eggs are laid in the tender twigs of trees and if no trees are available for propagation is largely prevented. Birds are enemies of the insects, especially the English sparrow, a fairly recent importation from the old world.

The insects cause no permanent damage to mature trees, but may seriously injure young trees or nursery stock. No remedy is practicable against them in large numbers over large areas,

Research Prize of $1,000

The Ellen Richards Research Prize is offered for award in the year 1924. Theses by women based on independent laboratory research are eligible for competition and must reach the Committee before February 25, 1924.

If the prize is not awarded a grant is available under certain conditions.

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326. The Phylogenetic Method in Taxonomy, by Hall and Clements.

336. Experimental Pollination, by Clements and Long.

327. Mutant Characters of **Drosophila melanogaster,** by Bridges and Morgan.

328. Genetic Studies on **Drosophila virilis,** by C. W. Metz.

329. Body-build and its Inheritance, by C. B. Davenport.

323. Diabetic Metabolism with High and Low Diets, by E. P. Joslin.

324. Under-nutrition in Steers, by Benedict and Ritzman.

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but orchards and shrubs may be partly protected by thorough hand-picking, dusting with pyrethrum powder when the insects have just emerged from the shells in which they emerged from the ground, or spraying with kerosene emulsion at about the same time.

A NEW ARSENICAL DRUG

Science Service

A NEW drug for general paralysis and locomotor ataxia has just been reported to the American Medical Association by Drs. W. F. Lorenz, A. S. Loevenhart, W. J. Blackwen and F. J. Hodges, of the University of Wisconsin.

The new drug is an arsenical, called "tryparsamid," and it has been found more effective than any other treatment used in early forms of general paralysis and in other kinds of syphilitic infection of the nervous system.

Out of forty-two far advanced paretic cases in a hospital for the insane, twenty-one were discharged after tryparsamid treatment and were able to go to work, the investigators report. In the twelve cases of the early type, seven fully recovered their normal mentality and five seemed mentally able to earn their living, but still presented signs of the disease as shown by laboratory investigation.

An official of the American Medical Association said: "The physicians' conclusions seem modest in view of the results they report."

Most of the patients treated by the Wisconsin investigators were insane and had been for long periods in an institution for the care of such patients. There were also included twelve fairly early cases which had not degenerated greatly and who showed instead of mania merely excitable disorders. There were also fourteen patients entirely free from mental symptoms, but in whom laboratory examination revealed signs of the early development of this disease. Finally, there were ten cases of locomotor ataxia and nine cases in which the nervous system was involved by syphilis without having developed either locomotor ataxia or general paralysis.

The patients made a decided gain in weight and their general state of health seemed remarkably improved. A complete investigation shows that a combination of the new remedy with mercury is more effective in the treatment of general paralysis than any method thus far outlined.

Tryparsamid is another of many combinations containing arsenic as the factor depended upon to kill the infecting germs of syphilis. It is similar to the famous "606," salvarsan, the first successful syphilis treatment. The chief value of the new drug is not so much in its direct effect on the infecting parasites as in its action on the ulcers or other forms of inflammation caused by them. Tryparsamid was first made by Jacobs and Heidelberger, American chemists, in 1915. In 1919 workers at the Rockefeller Institute tested it on infections in animals.

The only drawback to the treatment is the possibility of injury to the eye with this preparation as with the well-known "606" or the earlier preparations described by Ehrlich, the discoverer of the first arsenical remedies of this kind. There is a possibility of seriously affecting the nervous tissues associated with vision and the Wisconsin investigators caution physicians against the employment of dosages sufficient to bring about such serious results.

Approximately five per cent. of those infected with the venereal disease, syphilis, later develop general paralysis, and from thirty to forty per cent. of persons with this serious venereal disease later show evidence that the disease has reached the spinal fluid.

CATALYSIS AND THE MOTOR FUEL PROBLEM

A. C. S. News Service

CATALYSIS, that strange principle of chemistry which works in ways more mysterious and inexplicable than almost any other of the many curious phenomena of science, seems to have come to the rescue in the threatened shortage of motor fuels.

Dr. Edward Sokal, of New York, a member of the American Chemical Society, has made a discovery which extensive experiments now in progress may prove to be a great boon and aid in the general effort to get greater economy out of gasoline as used in internal combustion engines.

H. E. Howe, editor of *Industrial and Engineering Chemistry*, the industrial journal of the American Chemical Society, predicts that the words "catalysis" and "catalyst," or "catalyzer," will soon become a general addition to the vocabulary of Americans, in the same manner that "wave-length" and other technical terms suddenly came into use through the wide popular familiarity with the principles of radio.

In some of the most important applications of chemistry, industrially, of the present day, the principle of catalysis is proving of the utmost importance. In the fixation of nitrogen from the air, particularly, this is true, and it seems likely that some of the greatest scientific advances of the future will depend principally upon this odd faculty which some substances possess—the faculty of speeding up the rate of chemical reactions and of acting as a "mixer."

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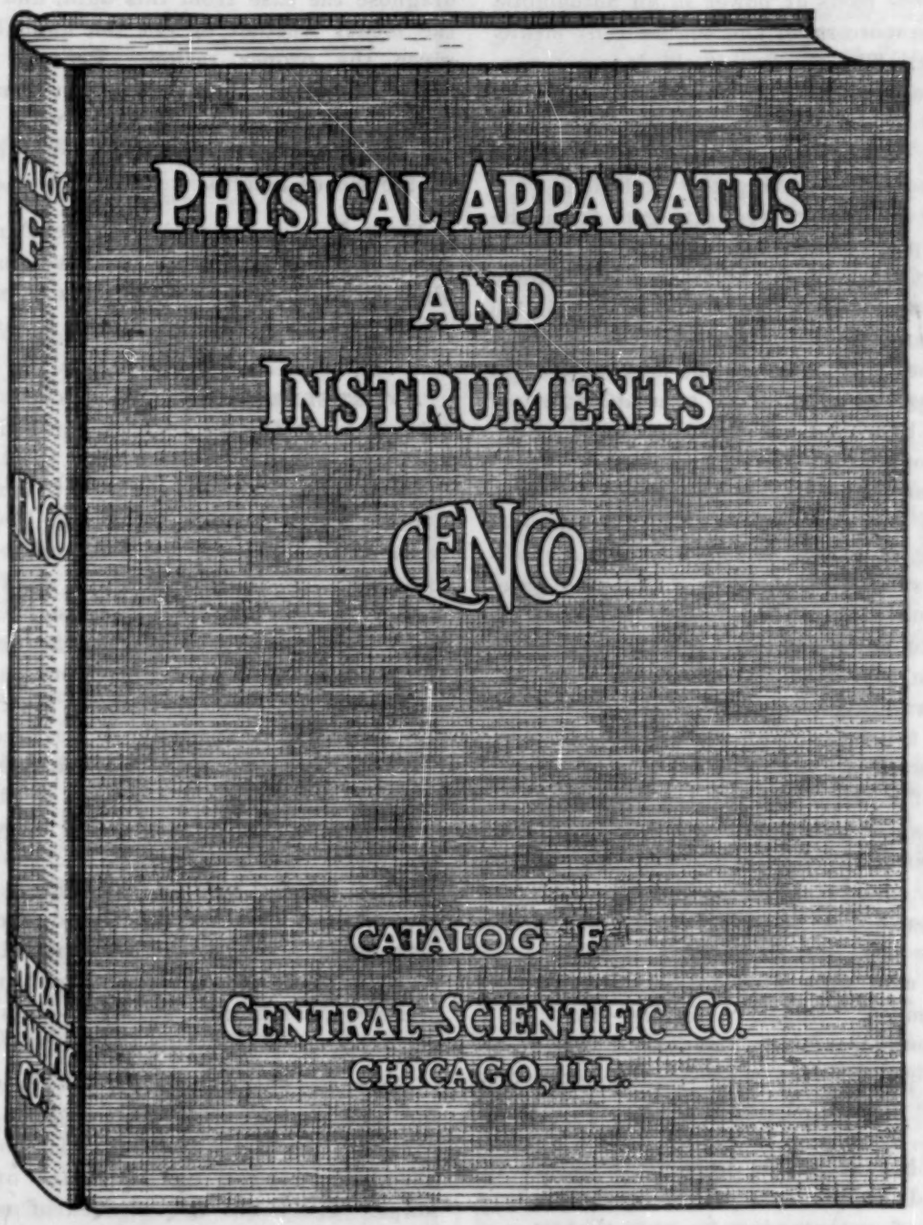

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In the particular instances at hand, Dr. Sokal found that certain chemical compounds and elements by their presence increase the rate at which a mixture of gas and air under pressure will burn. This means, simply, that the explosion, which is the basis of power in an automobile engine, is made more rapid and complete by means of the catalyst. The catalyst itself does not participate in the explosion, and remains the same after the fuel has burned as before. The mere fact that it is present in the combustion chamber does the work of accelerating the explosion.

In the case of fixing free nitrogen from the air, the principle works in the same way. Nitrogen is an inert gas and combines very reluctantly with other gases. In making this gas available for fertilizer and other purposes, it must be combined with other elements, and the most successful present-day method is to cause a combination of nitrogen and hydrogen to form ammonia. This can not be done at a satisfactory rate of speed without the use of a catalyst. A special compound of iron and some other metals, in particles about the size of a pea, is one of the most successful catalysts. The passage of the two gases through a tube containing such iron pebbles causes them to unite and nitrogen to be fixed so that it can be converted into fertilizer.

Dr. Sokal's catalyst, acting in the same way, is applied to the interior of the cylinder head or firing chamber of an internal combustion engine, in the form of a refractory paint. Tests made on various types of automobiles show that an increase in power is obtainable with the use of the catalyst, and examination of the exhaust gases of automobiles on which tests are being made indicate that the combustion is more complete. Such cars were able to operate satisfactorily on a much "leaner" mixture—that is, a greater proportion of air and less of gasoline vapor—and thus achieved a considerable economy. The complete results of these tests are not yet available.

Dr. Sokal has not made public the nature of the compound of the catalyst he uses, pending the issuance of patents, but he says that it can be applied to practically all types of internal combustion engines now in general use and that the cost of applying the catalyst will be low.

ITEMS

Science Service

In order to bring up-to-date feeding methods to the attention of all live-stock raisers in the country, the Bureau of Animal Industry of the U. S. Department of Agriculture is now offering a free individual feeding service. Farmers are furnished with problem sheets with blanks for showing the condition of the animals and how they are being fed. After filling in these blanks, the farmer can forward the sheet to his county agent, state agricultural college or direct to the department at Washington, where the experts diagnose the case from this data, and then advise the feeder whether or not the animals are being given the proper ration. Returns already received indicate, officials said, that many animals are not getting enough protein with their roughage, timothy hay frequently being used instead of the richer alfalfa.

Heat from a hot spring in the Pyrenees equivalent to a ton of coal an hour is being used by a French fruit raiser to force fruits so that they can be gathered for the market before their regular time.

Advertisements urge us to eat vitamin-containing yeast for the sake of our bodies, but now scientists have discovered that yeast itself must have a new vitamin before it can grow and flourish. Drs. Casimir Funk and Freedman have reported to the Society for Experimental Biology and Medicine that yeast fails entirely to grow when fed on very pure cane-sugar. This specially prepared sugar could not be detected chemically from other pure sugar, but the yeast cells placed on the very pure sweet stuff were latent and presented a spore-like appearance. The scientists concluded that a new vitamin D, not the same as vitamins A, B and C that influence animal nutrition, is necessary to yeast growth and that, moreover, yeast can not synthesize vitamin B, for which it is famed, without this new vitamin D. Drs. Funk and Freedman claim that other investigators in reporting growth of yeast on pure vitamin-free media neglected the presence of infinitely small amounts of this new factor D.

Further development of a system of charts for aerial navigators corresponding to those prepared by the Hydrographic Office for mariners is now being studied by the Board of Survey and Maps. The board is composed of representatives from all the government departments interested in the making or the use of maps. Aerial navigation is developing so rapidly that the charts at present available are not keeping pace with it; hence the need for improvement. The Hydrographic Office is already engaged in this work along the coasts, and has prepared modern aviation charts for about twenty miles inland. The maps do not give the detail ordinarily given in topographic maps. Land and water boundaries are accurately shown as are the principal roads and railroads, while prominent landmarks such as factories or church spires are emphasized.

Cornell University Medical College

First Avenue and Twenty-eighth St.
NEW YORK CITY

The first year of the course is also offered at Ithaca, N. Y., subsequent years at New York City only.

For Information Address
THE SECRETARY

Johns Hopkins University
Medical School

The Medical School is an Integral Part of the University and is in the Closest Affiliation with the Johns Hopkins Hospital.

ADMISSION

Candidates for admission must be graduates of approved colleges or scientific schools with at least two years' instruction, including laboratory work in chemistry, and one year each in physics and biology, together with evidence of a reading knowledge of French and German.

Each class is limited to 75 students, men and women being admitted on the same terms. **Except in unusual circumstances, applications for admission will not be considered after July 1st.**

If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

INSTRUCTION

The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School,
Washington and Monument Sts., Baltimore, Md.

SUMMER WORK FOR GRADUATES IN MEDICINE

Beginning Monday, June 4th, and ending Saturday, July 14th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

SCHOOL OF MEDICINE

Western Reserve University
of Cleveland, Ohio

HIGH STANDARD OF ADMISSION*
RESTRICTED CLASSES
THOROUGH INSTRUCTION
LARGE CLINICAL FACILITIES
HIGH STANDARD OF SCHOLARSHIP

**Admission confined to students having academic degrees and to Seniors in Absentia.*

For information address:

THE REGISTRAR
1353 East 9th St., Cleveland, O.

YALE UNIVERSITY
SCHOOL OF MEDICINE

Affiliated with the New Haven Hospital and New Haven Dispensary

111TH SESSION

Reorganized on a full-time basis

Entrance Requirements: A minimum of three years (or its equivalent) of college including general biology, physics, general and organic chemistry, qualitative analysis, physical chemistry or laboratory physics, and either French or German.

ALL THE GENERAL FACILITIES OF THE UNIVERSITY ARE AVAILABLE TO MEDICAL STUDENTS

As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

THE DEEPEST MINES

Science Service

BRAZIL still contains the mine that goes the deepest below the surface of the earth, although the deepest below sea-level and the nearest therefore to the center of the earth is in the United States. So said Dr. Thomas T. Reed, of the United States Bureau of Mines, in a recent address before the New York section of the American Institute of Mining and Metallurgical Engineers. He has recently returned from a visit to the Brazilian mine.

The deepest hole in the earth is a gold mine in the state of Minas Geraes and is known as the Morro Velho or St. John del Rey mine. It is owned by the St. John del Rey Mining Company, an English corporation, which has been working it almost continuously since 1834.

The mine is now 6,726 feet below the surface at the top of the shaft through which it is entered. The next deepest mine is in the Kolar gold field of India, where one shaft descends to 6,140 feet. The Village Deep mine in South Africa goes to 6,100 feet. The deepest in the United States is Tamarack No. 5, a copper mine in the Lake Superior region, with a depth of 5,308 feet. The bottom of this shaft is 4,100 feet below the level of the sea, while that of the St. John del Rey is only 3,958 feet below sea-level, since the mouth of the shaft is in a mountain country 2,768 feet above sea-level. The Tamarack mine goes nearest to the center of the earth.

The temperature of the rock at the lowest level of the St. John del Rey mine is 117 degrees. The miners work in an air temperature of 98 degrees. The outside air has an average temperature of 68 degrees, but is cooled to 42 degrees before being forced to the lowest levels from which it is drawn to the surface by powerful fans. On its way to the lowest depths it gains heat from the rocks and from its own compression, because air at that great depth is considerably denser than air at sea-level.

The mine is a dry one, there being no water at the lower levels, and because of the low relative humidity of the air which has been dried before being forced into the mine, the men are able to work under satisfactory conditions. The average pay is about a dollar a day.

The St. John del Rey mine is not only the deepest mine in the world, but is organized by the oldest registered English mining company, organized in 1830 to work a mine at a place some distance from the present workings. This mine proved to be unprofitable, and in 1837 operations were transferred to the present site where they have since been carried on almost continuously.

The deepest hole in the bedrock foundation of the crust of the earth has been recently reported to have been drilled in South Africa. It is not the deepest from the surface, but the point is that its 5,300 feet of depth is all in the pre-Cambrian strata, the underlying rocks which were laid down and finished some hundred million or so years ago.

Scientists of the American Geophysical Union are much interested in the deep drilling, and it has been suggested that the secretary of the organization communicate with the proper authorities in South Africa so that the temperature of the boring at various depths might be ascertained.

Taking mother earth's temperature is one of the most difficult of tasks, although much attention has been given to it, and, while much is known of the temperature of her skin, about which men walk and in which they dig a little, just what her real bodily temperature is no one really knows accurately. The reported digging is the deepest into the real depths of the earth's crust, which in that part of South Africa are practically on the surface. They are free from volcanic activity or other changes which might affect their temperature locally, having come to stability millions of years before there was life on the earth's surface. Their temperature would, it is believed, be an important clue to the problem of the earth's internal heat.

THE ELIMINATION OF OFFICE NOISES

Science Service

AN oil-cloth ceiling, full of small holes, over a thick layer of felt, is the latest contribution of acoustical science to the elimination of office noises. As explained by Clifford M. Swan, consulting engineer, this special ceiling has reached that stage of perfection which will do away with annoying reverberation.

Tests in offices of banks, department stores and other large mercantile establishments have shown that the perforated ceiling greatly reduces office noises and substantially produces the effect of an office in the open air.

Northwestern University
MEDICAL SCHOOL

Situated in Chicago in close proximity to important Hospitals with an abundance of clinical material.

ADMISSION REQUIREMENTS—Two years of College credit including a satisfactory course in Physics, Chemistry, Biology or Zoology, and French or German.

COURSE OF STUDY—leading to the degree of Doctor of Medicine—Four years in the Medical School and a fifth year either as Interne in an approved hospital or devoted to research in some branch of Medical Science.

GRADUATE INSTRUCTION—in courses leading to the degree of Master of Arts or Doctor of Philosophy.

RESEARCH FOUNDATION—The James A. Patten Endowment for Research affords unusual opportunities for advanced students of Medical Science to pursue special investigations.

RESEARCH FELLOWSHIPS—Four fellowships of the value of $500 each are awarded annually to promote scholarly research.

Tuition fees of the first and second years, $190.00 a year. The third and fourth years, $200.00 a year.

For information address

C. W. PATTERSON, Registrar

2421 South Dearborn Street, Chicago, Illinois

BOSTON UNIVERSITY SCHOOL OF MEDICINE

ORGANIZED IN 1873

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BOSTON, MASSACHUSETTS

Marine Biological Laboratory

Woods Hole, Mass.

INVESTIGATION

Entire Year

Facilities for research in Zoology, Embryology, Physiology, and Botany. Eighty-four private laboratories $100 each for not over three months. Thirty tables are available for beginners in research who desire to work under the direction of members of the staff. The fee for such a table is $50.00.

INSTRUCTION

July 3 to August 14, 1923

Courses of laboratory instruction with lectures are offered in Invertebrate Zoology, Protozoology, Embryology, Physiology and Morphology and Taxonomy of the Algae. Each course requires the full time of the student. Fee, $75.00.

SUPPLY DEPARTMENT

Open the Entire Year

Animals and plants, preserved, living, and in embryonic stages. Preserved material of all types of animals and of Algae, Fungi, Liverworts and Mosses furnished for classwork, or for the museum. Living material furnished in season as ordered. Microscopic slides in Zoology, Botany, Histology, Bacteriology. Catalogues of Zoological and Botanical material and Microscopic Slides sent on application. State which is desired. For catalogues and all information regarding material, address:

GEO. M. GRAY, Curator, Woods Hole, Mass.

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

Research Prize of $1,000

The Ellen Richards Research Prize is offered for award in the year 1924. Theses by women based on independent laboratory research are eligible for competition and must reach the Committee before February 25, 1924.

If the prize is not awarded a grant is available under certain conditions.

For circulars of information and application blank, apply to

DR. LILIAN WELSH,

Goucher College Baltimore, Maryland

For further information apply to the Secretary, Mrs. Samuel F. Clarke, Williamstown, Mass.

The most common source of acoustical trouble is reverberation. This is more true to-day than it used to be, owing to modern fire-proof construction, with its hard walls and plain surfaces. In the technical sense reverberation signifies the prolongation of a sound by its multiple reflection from surface to surface before its energy is sufficiently absorbed to become inaudible. Since the average sound must be reduced approximately to one millionth of its original intensity before it reaches the limit of audibility, and since such a sound once produced in a bare room loses but from two to four per cent. of its energy at each reflection, it is evident that such a sound must be reflected several hundred times before it becomes inaudible. Since this process consumes time, owing to the finite velocity of propagation, the sound is prolonged for a period of several seconds after the original source has ceased to emit energy.

It is this reverberation, particularly of high-pitched noises, that has been found to be most distracting and tiring to the worker. It is only by the unconscious expenditure of energy, indeed, that an office worker can get "accustomed" to noise. It is the function of acoustical engineering to do away with reverberation and with high-pitched noises.

The remedy now offered, with the perforated ceiling of oil-cloth and felt, is based on the researches of the late Professor Wallace C. Sabine, of Harvard University, who is recognized everywhere as a world authority on acoustics. The felt eliminates the reverberation by absorbing high-pitched sounds of short wave lengths. The perforated oil-cloth provides a covering for the felt which obviates the reflection which would take place from an unbroken painted cloth surface.

RADIO TROUBLES

Science Service

CAUSES of two of the principal difficulties in radio transmission, "fading" and "dead spots," are the subject of a thorough research now in progress at the United States Bureau of Standards.

Everything connected with radio-circuits, tubes, antennæ and other factors involved has been thoroughly studied except the radio waves themselves. The present investigation is intended to give greater knowledge of what happens in the transmission of these waves. The first phase to be studied has been that of the mysterious phenomenon known as "fading," or irregular variation of the signals the amateur hears at night.

A related problem, one of the pet worries of the arm-chair radio fan, is "Why is a dead spot?" More locally the question is, "What's the matter with Baltimore?" Owners of receiving sets in that city found themselves barely able, or more often unable to hear signals or concerts from Washington, 40 miles away, while stations at much greater distances were received clearly. Messages from Washington to Baltimore frequently have to be sent by way of Boston or New York.

Some of these things sounded rather doubtful to the scientists when the amateurs began to complain of them, but further investigation showed the problem to be a real one and to exist everywhere. It is believed to be intimately associated with the general problem of atmospherics, and variations of signal intensity by day and by night, and to lead to the discovery of some of the peculiarities of the ways in which radio waves are transmitted.

All these phenomena are related, says Dr. J. H. Dellinger, of the Bureau of Standards, to properties of the little known "Heaviside" surface, the boundary of the outer conducting portions of the atmosphere, which surrounds the earth at a height of from 50 to 100 miles. When this is in good working order, transmission is good; when it gets ruffled or disturbed the reverse is the case.

What causes the disturbances in this layer is still unknown, as is the cause of "dead spots," but it is known that "atmospherics" which are thought to be due to its disturbances have certain centers of action from which they proceed to cause varying degrees of mental and aural anguish to radio fans. One of these centers is over the state of Texas, another is in California.

A scientific paper on the investigation of the fading of signals and other radio-wave eccentricities is soon to be issued by the Bureau of Standards. These researches are still under way and promise future results of great importance, for if the cause of these trials of the great army of "listeners in" can be determined a big step toward a remedy will have been taken.

ECLIPSE EXPEDITION OF THE LEANDER McCORMICK OBSERVATORY

Science Service

AN expedition, led by Dr. S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, will observe the total eclipse of the sun on September 10, probably from the Catalina Islands off the coast of Southern California.

An OPPORTUNITY for an EXCEPTIONAL BOY

We expect to take on two boys this fall who have shown themselves able to advance more rapidly in technical studies than can be done in the regular school systems.

Instruction will be entirely individual. Boys will be expected to study all sides of our work, besides liberal studies outside, giving probably half the time to the particular field of their choice, production methods with time and cost studies, electrical and mechanical design and research, or technical sales. Part time will be spent in practical work in the shop. The entire schedule will be laid out in consultation with the boy and parents, and an effort made to give the best training that the law allows.

REQUIREMENTS: Age, 14 preferred. No boy over 16 will be considered. Boys under 14 meet many legal obstacles. Must satisfy us of ability to advance to responsible positions, and an inclination toward some line of our work. Apply as early as possible, not later than August 1st.

Forbes & Myers

Worcester, Massachusetts

A LARGE LABORATORY handling many development problems along the lines of physical and electrical measurement, needs a man for model work. The laboratory is part of a large industrial organization manufacturing many lines of apparatus. A man who is more than a mechanic is wanted. He should have the ability to design and make working models from bare ideas. It is expected that he will act as a mechanical assistant to the engineer in charge of the laboratory. Unusually good opportunities for advancement within the organization will arise for a man who is worthy for advancement.

Address Box D, care of The Science Press, Grand Central Terminal, New York City.

ZOOLOGIST with five years' university teaching experience desires position. Address A, c/o Science, Grand Central Terminal, New York City.

WANTED—A man who has had at least one year of graduate study in biological subjects for a position as Adjunct Professor of Biology at a salary of $2,000.00. Address, B, care of The Science Press, 3939 Grand Central Terminal, New York City.

GENERAL PHYSIOLOGIST.—Young man with six years of college and university teaching experience, now completing work for Ph.D. in physiology, desires opportunity to teach general physiology, commencing in the fall. E. H. Brunquist, 176 Bryant St., Palo Alto, California.

WANTED BY A WOMAN in September, a position as SOCIAL PSYCHOLOGIST AND ANTHROPOLOGIST. Training in anthropology was under the late Alex. Chamberlain, P.L.D., author of "The Child a Study in the Evolution of Man." A position as professor of anthropology in a college for women might be considered. Experience and credentials of the best. Address, C, care of THE SCIENCE PRESS, Grand Central Terminal, New York City.

GEOLOGIST, with nineteen years' field experience in practically every line of geology in seven countries, with teaching experience in two colleges and three universities, broad academic training, considerable published work, experienced in managing large enterprises and satisfactory references desires situation in non-state university or college. Charles Laurence Baker, 10 Mosswood Road, Berkeley, California.

TEACHERS WANTED

College positions with desirable salaries offered teachers for all departments of the Sciences. Special terms. The Interstate Teachers' Agency, Macheca Building, New Orleans, La.

Mosses with Hand-lens and Microscope

Cloth, $7.00; 8 x 11 inches, 416 pages, 88 full-page plates and 265 figures in the text.

"Must be considered the most important work that has yet been published on American mosses."—John Macoun.

Mosses with a Hand-lens (224 pp., 8vo, copiously illustrated), describes 150 mosses and 50 hepatics that can be identified by means of the Hand-lens alone. $1.75.

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1 Vine Street, New Brighton, N. Y.

PHONELESCOPE

Teaches Through the Eye

SOUND, ELECTRICITY

HERBERT GROVE DORSEY GLOUCESTER, MASSACHUSETTS

Dr. Mitchell has made a specialty of observing the spectrum of the sun during total eclipses. As long as a small portion only of the sun is visible, its light is so powerful that the ordinary solar spectrum of dark lines on a bright background is always found. But at the instant of totality everything is changed. The dazzling disk of the sun is covered up, and the sun's atmosphere of heated gases is then permitted to give its spectrum without interference from the more brilliant light of the solar surface. The spectrum of the heated solar gases, the so-called "chromosphere," consists of a series of bright lines on a dark background. The change from the dark-line or Fraunhofer spectrum to the bright-line spectrum of the chromosphere takes place at the instant of the beginning of totality. The change is an abrupt one and the bright lines are seen to flash out so suddenly that the spectrum has been called the "flash spectrum."

Since its discovery by Young, of Princeton, in 1870, observation of the flash spectrum has found a very important place at each total eclipse of the sun. At first the observations were made visually, but greater and greater success has been obtained by the use of photography. The flash spectrum was first successfully photographed as recently as the eclipse of 1896.

There are many problems that can be studied only under the conditions of an eclipse. Such observations with the spectroscope furnish the constitution of the solar atmosphere and the height in miles to which each gaseous layer extends above the surface of the sun. It is safe to say that these researches have given more information regarding the gases in the sun's atmosphere than is known of the earth's atmosphere from the work of all the weather bureaus all over the world, and this in spite of the fact that we live and move and have our being in the earth's atmosphere while the atmosphere of the sun is ninety-three millions of miles away.

This will be the fifth total eclipse which Dr. Mitchell will have witnessed, yet the total time for observation which has been available from the preceding four is only ten minutes. The spectroscope used in the coming eclipse will consist of a powerful Rowland grating ruled on a concave surface and used without a slit.

THE DETECTION OF CARBON MONOXIDE POISONING

Bureau of Mines

THROUGH investigations conducted by government technologists' methods of detecting carbon monoxide, most insidious and deadly of poisonous gases, have been greatly simplified. Secretary of the Interior Work has made a public announcement to this effect and through a letter informed 700 industrial physicians and surgeons throughout the country of this new discovery:

For some time the Bureau of Mines of the Interior Department has been conducting research work with the result that means have been found by which it is possible to discover within three minutes the extent that a person has been affected by carbon monoxide gas through the extent of poison saturation in the blood. Formerly it took approximately from 24 to 48 hours before diagnosis could be made of such cases either in hospitals or well-equipped laboratories with the services of a skilled organic chemist. The test is effected through a simple and inexpensive instrument which may be carried in the pocket and which requires no special training for its operation.

Many human lives are expected to be saved by the general adoption of this mode of finding gas poisoning, particularly in the mining industry, as well as other fields where dreaded gases are a menace. With this quick method of diagnosing it is possible to promptly institute the proper emergency treatment.

Carbon monoxide is the universal industrial poison gas and manifests itself at mine explosions and fires, combustion of explosives in the atmosphere around coke ovens, coal gas, water gas and producer-gas plants, as well as in the exhaust gases of automobile engines, improperly constructed and operated kitchen gas ranges, and in smoke from burning buildings.

Because of possible exposure of citizens in all walks of life sooner or later to its deadly influence the new instrument for detecting it in the blood is expected to be in universal use among the physicians within the near future. Symptoms of carbon monoxide poisoning consist of headache, dizziness, weakness in the legs, increased respiration at first which becomes irregular and depressed, finally resulting in collapse, unconsciousness and possibly death.

With the letter sent to the 700 industrial physicians of the country was a report of the investigations of the department's Bureau of Mines giving detailed information of the dangers of carbon monoxide poisoning and describing the latest discovery for detecting it.

PHYSIOLOGICAL EFFECTS OF HIGH TEMPERATURES

Science Service

VENTILATION is of little use in reducing discomfort from high temperatures in humid air, after the temperature has risen to approximate-

Compression Carbon Rheostats

For service that requires exceedingly "fine" and uniform current regulation, we offer the following rheostats:—

No.	Normal Rating Watts	Approximate Range of Resistance	Dimensions of Carbon Blocks	Approximate Over-all Dimensions	List Prices
*10	250	.06—6 ohms	50 blocks $\frac{3}{16}$" thick 1½" square	15½" lo'g 4½" wide 5½" high	$12.50
20	1000	.04—4 "	65 blocks $\frac{3}{16}$" thick 2" square	20" long 5½" wide 6" high	$25.00
30	1500	.01—2 "	60 blocks ¼" thick 3" square	22" long 7¼" wide 7½" high	$50.00
40	3000	.005—1 "	60 blocks ¼" thick 4" square	22" long 8" wide 9" high	Price on application

*This rheostat is supplied with three movable terminal plates, as shown in the picture.

Write for illustrated descriptive Bulletin No. 980

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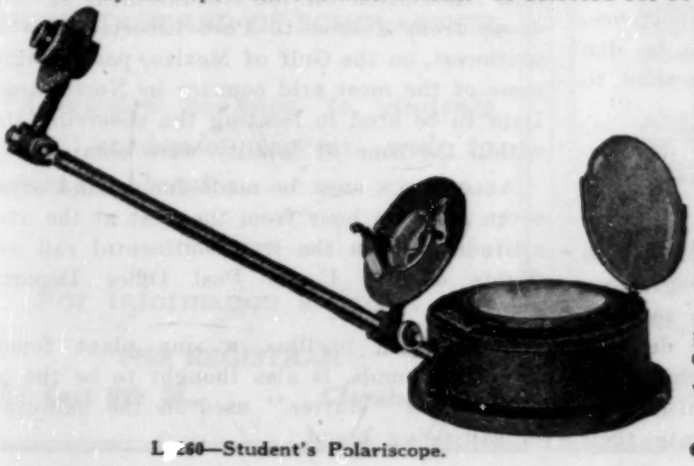
STUDENT'S POLARISCOPE AND ACCESSORIES

Our new Student's Polariscope is a scientific instrument showing by the interference of light waves the remarkable color effects of polarized light. It provides one of the most fascinating experiments in Elementary Physics and constitutes a never-ending source of instruction and enjoyment.

The instant favor with which our larger Polariscopes were received, has led us to offer a smaller instrument containing all essential parts at a price well within reach of every school and college. Daylight or artificial light diffused by a ground glass plate is reflected at a polarizing angle by a black glass mirror to the stage. The stage may be rotated or shifted up and down the rod and carries a glass plate and clips for holding the object under examination. The latter is viewed through a nicol prism analyzer which rotates in a collar graduated to 5°, making quantitative measurements possible.

The base of the instrument is hollow and felt lined so that the preparations and accessories may be kept with the instrument. A selected set of accessories is listed below. A number of others, along with our larger Polariscopes are listed in Bulletin No. 102, which will be mailed on request.



L 260—Student's Polariscope.

L 260. Student's Polariscope.....$30.00
L 265. Set of Seven Accessories, comprising:
L 277. Glass Plate for Clamp.....$1.30
L 278. Pressure Clamp for showing double refraction in glass under strain.....$1.50
L 279. Rhombohedron of Iceland spar $1.00
L 286. Tourmaline Tongs.....$3.50
L 292. Spar Plate cut perpendicular to axis.....$6.50
L 295. Sheet of Clear Mica.....$1.00
L 296a. Design in Selenite.....$8.00
Complete at Special Price.....$20.00

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ly that of the human body, according to a report of recent experiments made by the United States Bureau of Mines on the physiological effect of high temperatures with and without air movement. In temperatures up to 95 degrees the movement of air caused much relief. At 100 degrees the symptoms were fully as severe with moving air as with still.

The experiments were carried out by Dr. R. R. Sayers, chief surgeon of the Bureau of Mines, and D. Harrington, supervising mining engineer. The subjects were experienced mine laborers. The work was carried on in deep and hot metal mines.

The principal effects of exposure to hot, humid and stagnant air were a rise in the body temperature of two or three degrees, a fall in the blood pressure, perspiration so profuse that the subjects' shoes were partly filled with sweat, and sensations of giddiness and weakness. These symptoms were all very pronounced at 95 degrees in stagnant air. If the air were in moderate motion, little discomfort was felt.

This was not the case, however, at temperatures of 98 degrees and more. Symptoms in still air, which were more trying than at the lower temperatures, were not much relieved by a current of air, while at 100 degrees they were so unbearable that even when the air was moving the subjects were not able to stand a full hour's exposure to the conditions.

More recently a more thorough study of the effect of high temperature has been made possible through the use of a specially designed room where any desired conditions of temperature, humidity and air movement which are likely to be met may be maintained.

From this a system of "comfort lines" is being worked out, a graphical representation of the combinations of temperature and moisture at which equal comfort is experienced. It has been shown that while humidity has a marked influence the temperature taken by the ordinary dry-bulb thermometer is of great importance. The discomfort experienced is shown to be due more to the increase in the pulse rate than to any other cause.

ITEMS

Science Service

DEVELOPMENT of hydroelectric power in South America, and especially in Brazil, is progressing on a large scale, according to reports received by the Pan-American Union. No great deposits of coal or oil are yet available and the countries of the southern continent are turning to their abundant water power to motivate their growing industries. Plans are now under way for the electrification of the railroad from Rio Janeiro to São Paulo, the principal city of southern Brazil, and the seat of some of its most important manufactures. The distance to be electrified amounts to about 400 miles. In the state of São Paulo, of which the city of that name is the capital, there were manufactured last year 7,000,000 pairs of shoes and 3,500,000 hats by machinery run by electric power. American machinery is used. Another development is the electrification of the railroad from Valparaiso to Santiago, Chile. All these projects depend upon water power, which is being used more and more, as in much of South America it is convenient to the places where it is to be applied.

INCUBATOR chicks have long been known; incubator cheese is the latest product of inventive ability in Wisconsin's cheese industry. The cheese incubator is the idea of J. D. Sammis, of the dairy staff of the Wisconsin College of Agriculture. The ordinary egg incubator is now used to detect milk unsuitable for cheese making. The incubator method can be applied to any one of the several curd tests now in use in cheese factories. In every one of these tests, the milk samples should be kept at a temperature of about 100 degrees Fahrenheit to give the best results. A modified egg incubator is now on the market for the new method. Instead of the egg trays, it is equipped with racks and glass tubes to hold the milk samples. Before the introduction of this latest method in the cheese industry, it was a common practice for cheese makers to hang their samples on the boiler room wall, which resulted in uneven temperatures and poor tests.

To locate a suitable place for observing the total solar eclipse on September 10, a party of six scientists, headed by Dr. A. E. Douglass, of the University of Arizona observatory, and Dr. D. T. MacDougal, general secretary of the American Association for the Advancement of Science, drove from Tucson to Port Libertad, 238 miles southwest, on the Gulf of Mexico, passing through some of the most arid country in North America. Data to be used in locating the observing station within the zone of totality were obtained.

ALLOWANCE must be made for a wind of about seven miles an hour from the west at the average altitude used in the transcontinental rail service flights of the U. S. Post Office Department aviators.

THE Welch bacillus, a tiny plant found in infected wounds, is also thought to be the active agent of a "starter" used in the manufacture of salt-rising bread.

Cornell University Medical College

First Avenue and Twenty-eighth St.

NEW YORK CITY

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For Information Address

THE SECRETARY

Johns Hopkins University

Medical School

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

SCIENTIFIC EXPEDITIONS FROM WASHINGTON

Science Service

SCIENTISTS are scattering to the wild and waste places of this hemisphere in their annual intensive attempts to wrest from nature additional secrets of the past. Archeological, ethnological, biological and geological expeditions are daily leaving Washington to take the field in lonely canyons and wide places of our own west and unsettled regions of Canada, South and Central America.

Dr. Charles D. Walcott, secretary of the Smithsonian Institution, and Mrs. Walcott are just leaving for British Columbia where they will hit the trail. He will study the rocks of the Rockies and read the stories written in fossils; she will paint the wild flowers and measure the melting of the glaciers.

C. W. Gilmore, Smithsonian paleontologist, has already begun to dig up gigantic fossil reptiles found near Jensen, Utah.

Sylvanus G. Morley, of the Carnegie Institution of Washington, is continuing his reconnaissance of the wilds of Yucatan and Guatemala, in his effort to locate further remains of the Maya, said to have been the most highly developed of America's ancient people.

Dr. J. Walter Fewkes, chief of the United States Bureau of American Ethnology, has just gone to the Cumberland Valley, Tennessee, to inspect excavations being made in Indian mounds there by W. R. Myer, archeologist. From there he will go to Colorado, Utah and New Mexico for further investigation of the abandoned apartment houses of the cliff-dwellers who once lived there.

Neil M. Judd, archeologist in charge of the National Geographic Society's explorations in Chaco Canyon, New Mexico, has already resumed work on Pueblo Bonito, one of the largest of the prehistoric Indian community dwellings.

M. W. Sterling, ethnologist of the United States National Museum, is preparing to leave for Mobridge, South Dakota, from which place he will proceed to another ancient Indian village site where skeletons, implements and other relics of an extinct people have been found.

To get information about the manners, customs and languages of living but rapidly disappearing Indian tribes, a number of investigators are leaving for sections more or less remote from civilization.

Dr. Truman Michelson, ethnologist, left this week for Labrador to study remnants of the Algonquin Indians on the southeastern portion of that peninsula. J. N. B. Hewitt will visit Wisconsin, New York State and Ottawa, Canada, to conduct studies among the Iroquois and other Indians, and Francis LaFlesche will study the material culture of the Osage Indians of Oklahoma.

Animals as well as men of the past and present are also the subject of exploration. C. R. W. Aschemeier, of the United States National Museum, has left for the Amazon to collect exhibit specimens, especially of the porpoises living in South American rivers and believed to be closely related to the sea-going species familiar to ocean travelers. Arthur deC. Sowerby, under the direction of Robert S. Clark and Charles M. Hoy, are now in troubled China hunting big game and other mammals for the government collections.

STANDARDIZATION

Science Service

EVERYTHING from needles and frying pans, fountain pens and desk tops, to fence wire and tent canvas is provided for in a proposed uniform system of indicating sizes by a geometrical series of numbers being investigated by the American Engineering Standards Committee. F. J. Schlink, assistant secretary of the committee, states that this is the most far-reaching and fundamental engineering development so far presented to his organization for study.

Sizes of many articles in use to-day are based on chance or outworn tradition. Nail sizes, for instance, actually originated in the cost expressed in English pence of 100 nails back in the days when nails were made by hand smithing, at a cost having no relation whatever to prices now current.

According to the proposed plan, the size of the article would be based on some property or dimension bearing definitely on its serviceability. Nails should probably be sized by driving strength, which takes into consideration length and wire diameter together, while the sizes of fountain-pen barrels would be based on actual ink capacity.

The chief feature of the system, however, is that each standard size is larger than the preceding size, not by a definite addition, but by a fixed percentage.

For instance, in the case of shoes, a given size instead of being one third inch longer than the

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preceding size would be a certain constant percentage longer. It is not the one sixth inch by which a shoe is too short or too narrow which makes it pinch, but the relation which that deficiency in length or width bears to the actual size of the foot being fitted. In large shoes, one sixth inch may be a satisfactory interval for comfortable fitting; while in a small shoe, say for a child's foot, one sixth inch above or below the proper size might be intolerable. This difference in length between the various sizes should not be constant all the way from the child's 4 inch shoe to the No. 12 adult's shoe which is 12 inches long, but should vary with the size; for most commodities a constant percentage increase over the preceding size will best serve the purpose. It is the homely idea of the inch on the end of one's nose, which is universally recognized as a bit awkward, though the same inch would be quite harmless when applied to larger objects.

Whatever the unit of measurement used in the different articles, all sizes of any given commodity would differ in a uniform and fixed proportion which would be represented by a series of numbers, say 10, 16, 25, 40, 64, 100 (each 60 per cent. greater than the preceding). By a simple shift of the decimal point a new series, 1.0, 1.6, 2.5 4.0, 6.4, 10.0, may be obtained, or again, 100, 160, 250, 400, 640, 1,000, providing for the very smallest or the very largest sizes for which there is any possible use. A freight car of 64,000 pounds capacity, or fence wire 64 thousandths of an inch in diameter, would thus alike be preferred number sizes. The series can start with any number and continue to the largest needed stock size, with additional intermediate numbers inserted according to a definite scheme, when needed.

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RACE HORSE ENDURANCE AND RED BLOOD CELLS

Science Service

THE reason that race horses have greater endurance than the average animal lies in the fact that they have a much larger proportion of red cells in the blood, according to Dr. Christian P. Neser, of the Division of Veterinary Education and Research at Onderstepoort, South Africa. Whereas the blood of a permanently stabled horse, which has practically no exercise, contains only about 23 per cent. by volume of red blood cells, some of the race horses when in severe training were found to have as high as 52 per cent. red corpuscles. Over half of the blood in such cases was made up of these microscopic red cells.

Dr. Neser, when making a comparative study of the blood of different equines, was puzzled over the marked variations in the proportion or erythrocytes—as red blood cells are technically called—in different animals. He could not correlate this condition with differences in food, age or sex, but did find, however, that all severely worked horses had without exception a much higher content of red blood cells than usual. The race horse, which was the most severely worked animal of any of those studied, had the highest content of red corpuscles in the blood, and, in these particular horses, this proportion was highest when it was in the height of training. Although horses, which had been bred for this type of service, always had a somewhat higher content of erythrocytes, this investigator found that the process of training was accompanied by a rapid increase in the percentage which continued until a maximum blood content was reached; this occurred when the horse was in full training.

This is just another illustration of the fact that the animal body when subjected to peculiar conditions adapts itself in a manner suited to the occasion. In this case the tissues, particularly the muscles, need oxygen faster than the blood normally supplies it to them. The erythrocytes, as is well known, function as carriers of oxygen and any great increase in these cells augments the oxygen carrying power of the blood; if this provision were not made, the muscles would not be able to stand the strain of racing on account of a lack of this essential constituent.

INHERITANCE OF MUSICAL ABILITY

Science Service

MUSICAL talent descends from parents to children in accordance with the known laws of heredity, according to the conclusions of two German scientists just reported to the American Medical Association by its Berlin correspondent. Professors Haecker and Ziehen, of the University of Halle, made an investigation for musical ability into the family histories of several thousand persons where one parent is musical and the other is not.

Boys are more musical than girls, they found, especially if their mothers had musical talent. The inheritance in that case seemed to go to the opposite sex, the girls of the family having no especial ability in music. Where both parents are musical the trait follows the regular laws of

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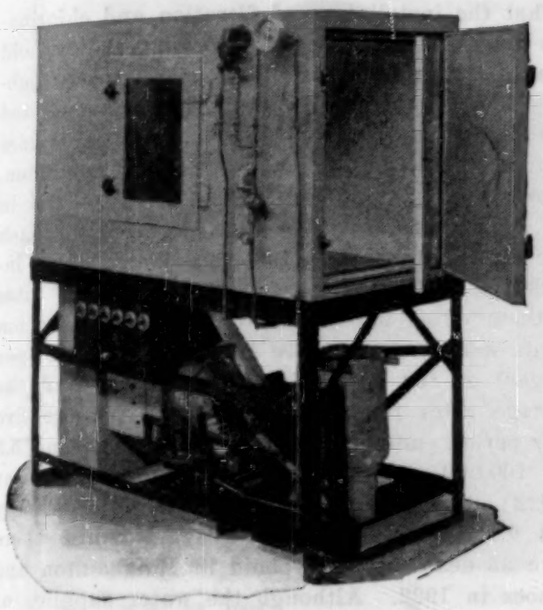

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heredity and 40 per cent. of the offspring have talent, 40 per cent. are somewhat musical, and 20 per cent. have little or no musical ability.

Children with marked inherited ability frequently exhibit it before the end of their second year. As might be expected, musical talent is usually discovered earlier if the parents are musical. Children of such parents can frequently sing correctly before they can talk.

Indicating that musical ability may develop in the absence of musical training in childhood, the cases of 46 composers are cited, 13 of whom had no opportunity to hear good music in their younger days.

Studying the relation between musical and other talents the investigators found that a gift for music is likely to mean the absence of a taste for mathematics, but to indicate in many cases a gift for drawing and for poetry.

PURE WATER IN NEW YORK STATE

EIGHTY-SIX per cent. of the people of New York State are now supplied with drinking water from public supplies and 73 per cent. of the population is served by treated or purified water, according to C. E. Holmquist, director of the Division of Sanitation of the New York State Department of Health, who has just completed a special investigation and report on the filtration and chlorination of the public water supplies of the state. Mr. Holmquist finds that 9,182,000 persons in New York State out of a total estimated population of 10,651,000 are now supplied with water from public water supplies and that 7,796,000 persons are served with treated or purified water.

The increase both in the number of persons served by public water supplies and those served by treated or purified water supplies has been marked during the past two decades, according to Mr. Holmquist's report. In 1906, when the Division of Sanitary Engineering was organized and supervision over public water supplies was commenced, about 6,000,000 persons were served by public water supplies and only about 700,000 persons in the state were served by purified public water supplies. It will be seen therefore that since 1906 there has been an increase of some 53 per cent. in the number served by public water supplies and an increase of over 1,000 per cent. in the number of persons served with water from purified supplies.

The improvements in the sanitary quality of public water supplies of the state appear to be reflected in the decrease in the typhoid fever death rate. The average death rate for the 22 year period from 1885 to 1906 inclusive was 23.6 and since 1906 there has been a marked and fairly uniform decrease in the typhoid fever death rate until 1922 when it reached the remarkably low level of 3 per 100,000. This rate compared with the rate before 1906 represents a saving of some 2,000 lives per year from typhoid fever alone.

That the installation of filtration and chlorination plants has resulted in decreasing the typhoid fever death rates, especially in places where public water supplies are derived from polluted sources, is further shown clearly by the experience of four typical cities; viz., Albany, Binghamton, Cohoes and Niagara Falls. A decided drop in the typhoid fever death rate occurred in each case immediately after filtration plants were installed. The average typhoid fever death rates in these cities before filtration and sterilization plants were installed were 89, 56, 99 and 132 per 100,000 of the population, respectively, and the average rates for these same cities for the five year period ending 1922 were 5.6, 3.7, 3.5 and 5.3 per 100,000, respectively. During the past year (1922) the death rate from typhoid in Albany was 0.9 and in Niagara Falls 3.6, while there were no deaths from typhoid in Binghamton and Cohoes in 1922. Although the water supplies of these cities are derived from large and, with the exception of the Binghamton supply, from grossly polluted rivers that receive large volumes of trades wastes and the raw sewage from communities numbering several hundred thousand persons, the death rates compare favorably with those for the rest of the state. Whereas other factors, such as improvements in milk supplies, have in all probability been instrumental in reducing the typhoid fever death rates in these cities, there seems to be no question but that the improvements in public water supplies have been the predominating factors.

GLASS METEORS

Science Service

POCKET-SIZED glass meteors, hitherto looked upon as the strayed waifs of science that no astronomer, geologist or other expert would admit to his department, were scientifically and publicly adopted into the distinguished family of heavenly bodies at the recent meeting of the Astronomical Society of Sweden, the adoption being sponsored by Professor A. Hoegbom, of the University of Upsala. The mysterious objects now proved to be of celestial origin are only an inch or two in diameter, consist chiefly of molten glass, are curiously marked, have been found in great numbers in Czecho-Slovakia, the East Indies and Australia, and under the name

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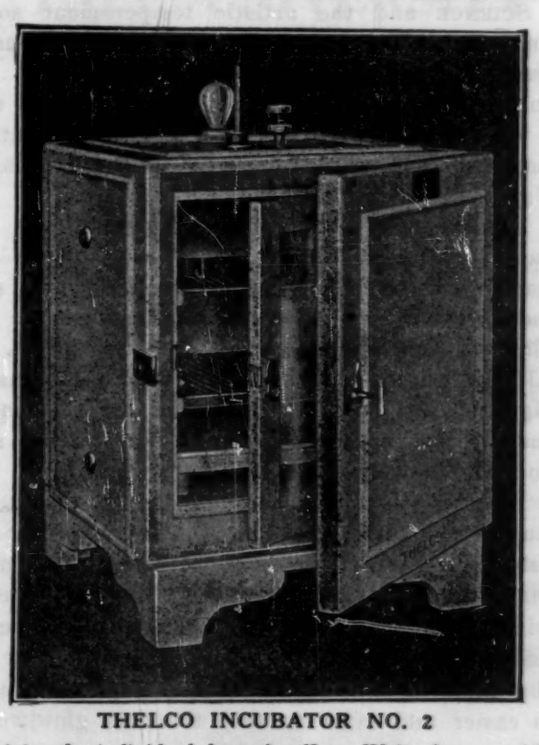

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of chrysolites or fulgurites have been sold as precious stones. They are now to be known as tektites.

Professor Hoegbom's solution of the mystery was interesting. All experts have agreed, he said, that tektites were formed by melting a mass. He then refuted the theory that they might have been formed by lightning, calling attention to the fact that no similar unmolten substance exists in the regions where the tektites are found. That glass-makers or chemists may have produced them is another theory. This also was refuted by proving that the existence of tektites dates back to the early stone age when primitive men used them for arrow heads, and that in those days men had neither the laboratory equipment nor the knowledge necessary for making these objects. On the theory, then, that tektites must have fallen from the sky, Professor Hoegbom undertook experiments to see what effect friction would have on molten tektite material shooting through the air with meteoric velocity, and was rewarded by the discovery that the curious patterns on these laboratory meteors were virtually identical with the tiny celestial bodies which have so long been a mystery.

FIREFLIES FOR THE WEST

Science Service

SCIENCE and the artistic temperament sometimes go well together. For example, the hard-headed scientists of the National Museum are going out on a still hunt for glow-worms so that a woman in Idaho with a love for the beautiful may enjoy fireflies in her garden on summer nights.

Fireflies, so abundant in the east, are unknown in nearly all the Far West. The Idaho woman, whose home is in Blackfoot, had seen them in the east and wanted them, so she applied to the National Museum. So Dr. J. M. Aldrich, of the museum staff, has been making nightly hunts on the lawns about the museum to ensnare any unsuspecting glow-worm which may be about and give him a long trip west.

Fireflies at this season are in the glow-worm stage; soft little crawlers, but carnivorous and subsisting largely on earthworms. They carry their own lights with them, but as yet have no wings. When transformed into their stage of existence for which wings are provided, they are the familiar fireflies of summer nights. But it is easier and safer to ship them as glow-worms than as fireflies.

Dr. Aldrich thinks that perhaps the reason why there are no fireflies in the arid and mountainous west is because the nights there are cool and the firefly thrives best where the evenings are warm. If that is correct, the Blackfoot woman may have her fireflies this summer, but they will not reproduce. In that case it is suggested that purveyors of garden seeds and supplies in the west add glow-worms to their stores. These might be bought with each year's seeds and would be guaranteed to light up a garden for one season.

ITEMS

Science Service

MEASUREMENTS of the heat received from the sun will soon be begun in Australia. The first solar radiation station is about to be installed there by representatives of the Smithsonian Institution which has been carrying on such work in Arizona and Chile for several years. A. F. Moore, director of the Mt. Harqua Hala radiation station, will sail from San Francisco on June 26 to set up the apparatus. Interest in solar radiation measurements began in Australia about two years ago when a group of scientists set out to find the means of setting up such a station. Means have recently been provided and the instruments will be set up by Mr. Moore at the Riverview College Observatory near Sydney. It is hoped later to establish a similar station in the arid interior region of the continent. Results from the Riverview station are expected to be of great interest and importance in comparison with the Smithsonian solar radiation stations in Arizona and Chile.

BROWN tail moths, the hairs from the caterpillars of which cause the extremely irritating human skin eruption known as "brown-tail rash," have suddenly shown an increase in New England after an almost complete disappearance, Dr. A. L. Quaintance, entomologist of the United States Department of Agriculture, declares. Similar measures to those used against the damaging gipsy moth will be used in an attempt to check the spread of this nuisance. The brown tail pest was brought to this country from Europe and first discovered at Somerville, Massachusetts, in 1897. In a few years it had spread throughout the New England states and become unbearable to the residents of many sections on account of its poisonous wind-borne hairs. Many thousands of acres of forests also were attacked by the insect and the trees defoliated. The prevailing winds have tended to cause the spread in a northeasterly direction into Canada, while disease among the insects in recent years apparently almost wiped them out. Now, however, they are again on the increase and causing trouble.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

A "SKELETON IN CLOSET"

Science Service

There is a "skeleton in the closet" of man's evolutionary history, and Prof. E. Dubois, former surgeon in the Dutch Army, holds the key. The "closet" is said to be a good stout safe in Haarlem, Holland, and the skeleton is none other than that of Pithecanthropus erectus, the famous ape-man who lived in Java over a half million years ago. For thirty years scientists from all over Europe have besieged Dr. Dubois for permission to examine the remains, while eminent anthropologists have crossed the ocean for that purpose only to be turned away at the door.

His locking up of these specimens and holding out on his fellow scientists has become an international scandal, and is credited with causing other scientists to follow the same policy. The Natural History Museum at Paris now has a number of skulls of cave men of the Neanderthal period which were discovered in 1912 which they refuse to allow scientists to examine thoroughly.

The Java ape-man remains were found by Dr. Dubois near Trinil in the central part of the island of Java in 1891. All that has been furnished the scientific world are casts of the top of the skull, and two teeth, and a photograph of the thigh bone in 1894. He concluded that these remains represented a true intermediate form between anthropoid apes and man. Some, however, believe they represent a very primitive man, others that they represent merely an extinct form of ape. To solve more definitely these problems, scientists have sought permission to examine the original petrified fossils themselves, but Dr. Dubois has refused on the excuse that he wished to publish his own findings first.

Scientists recognize that such action is proper if the findings are published within a reasonable time; but to explain the years that he has withheld his work it has been rumored that he was influenced by religious bigotry to which these bones were "a skeleton in the closet" in the general acceptance of that phrase.

The story of an unsuccessful pilgrimage to Dr. Dubois' home in Holland several years ago is told by Dr. Aleš Hrdlička, anthropologist of the Smithsonian Institution. He was simply unable to find Dr. Dubois's home. Dr. Hrdlička praises Dr. Dubois's exploration and early reports on the valuable bones, although he and many other scientists would like to see the originals, make their own measurements and form their own conclusions. "The final word concerning their exact age and true biological position has not yet been pronounced," said Dr. Hrdlička, in explaining that there was no room for doubt as to the place of discovery of the several bones and their geological relations.

The Java ape-man is the oldest of all the links tending to show man's rise in the world. From the geological strata in which it was found, it is estimated that it must have lived from 500,000 to a million years ago, making it nearly twice as old as the next oldest cave-man. The first human or near-human remains yet found, it was recently shown by Dr. Hrdlička, are those of the so-called Piltdown man found near London, England, and probably dating back over 250,000 to 300,000 years. He believed that modern man may have developed from this western type and that the Java ape-man represents an extinct branch and is not in the direct line of man's ascent.

PUEBLO BONITO

The National Geographic Society

NEIL M. JUDD, director of the Pueblo Bonito Expedition of the National Geographic Society, left Washington on May 5 to resume exploration of the most important prehistoric ruin in the United States at Chaco Canyon, New Mexico.

By May 15, Indians will be swarming over the walls of the ancient village, teams will drag wagon loads of earth and stone away, and steel dump cars will scurry back and forth over a miniature railroad. Almost overnight a canyon which had been deserted since years before Columbus came will become a beehive of industry.

Pueblo Bonito was an aboriginal apartment house of 900 rooms, four stories high, encircled by a single outer wall.

Viewed from the towering north cliff the ancient village is semi-circular, with the greater portion of its dwellings, or suites, grouped along the curved side.

A long row of one-story houses connects the extreme wings of the semi-circle. From the middle of the straight row a cluster of ceremonial chambers extended to meet the curved section, thus dividing the village, and providing for each half an open court. In these courts sacred dances and religious ceremonies were performed.

Some ancient walls still stand more than 30 feet high. Its 400 ground-floor rooms occupy an area almost equal to that of the United States Capitol.

Rooms of Pueblo Bonito are grouped in suites

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For further information apply to the Secretary, Mrs. Samuel F. Clarke, Williamstown, Mass.

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as in modern apartment houses. If they were all occupied at the same time the resident population of this aboriginal family hotel was between 1,500 and 2,000 persons.

The National Geographic Society has been exploring Pueblo Bonito for three years, but many puzzling problems remain to be solved.

Where was the water supply for this prosperous community? What forests furnished the hundreds of beams used in this colossal village standing now 40 miles from any timber of comparable size? Extensive fields in which our earliest farmers grew corn, beans, squash and other food plants now are buried.

Mr. Judd within the past ten years has organized and directed twelve archeological expeditions.

WEST INDIAN HURRICANES

U. S. Department of Agriculture

Several important points bearing on the origin and course of West Indian hurricanes have been brought out through a series of studies carried on by C. L. Mitchell, meteorologist of the Weather Bureau, United States Department of Agriculture.

The tracks of all tropical storms originating over the Atlantic Ocean, the Caribbean Sea and the Gulf of Mexico from 1887 to 1922 were plotted. Other data bearing on tropical disturbances were obtained from the daily North Atlantic charts of the Weather Bureau. Separate charts were made of the storms for each of the months when hurricanes are prevalent, from June to November, together with a few earlier and later storms. Classification of storms, according to their intensity, was included.

August and the first half of September show by far the greatest frequency of true hurricanes, many of them originating in the vicinity of the Cape Verde Islands. Some moved westward, entering the Caribbean Sea and passing south of Cuba and Haiti. Others turned to the northwest before reaching the Lesser Antilles and so passed north of Haiti and Cuba. The remainder moved northwestward, recurving in about latitude 25° N. to 30° N. and between longitude 50° W. and 70° W.

The most important results developed by the study are: (1) The great majority of tropical cyclones developed either over the western third of the Caribbean Sea or far to the eastward of the Lesser Antilles, especially in the vicinity of the Cape Verde Islands. None developed over the eastern two thirds of the Caribbean Sea. (2) The influence of anti-cyclones over the direction of progress of tropical cyclones is very marked. (3) Tropical cyclones recurve to the northward and northeastward at the first favorable opportunity, irrespective of longitude or time of year. (4) When the paths of tropical cyclones describe a loop it is always to the left.

ITEMS

Science Service

How insect dairy farms run by imported Argentine ants threaten the sugar supply from plantations of the South is revealed in a bulletin published by the Agricultural Experiment Station of the Louisiana State University. The mealy-bug, a tiny insect pest, feeds upon the tender parts of the sugar cane and kills or weakens the young shoots so that a poor stand of cane is the result. Before the introduction of the Argentine ant this damage was not great, as these insects have parasitic enemies which prey upon them and keep their numbers down. But the mealy-bug, the bulletin states, secretes a sweet, watery liquid or honey-dew, of which the Argentine ants are very fond. In order to protect the supply of this liquid, these ants build mud barns to protect the mealy-bugs from sunlight, rains, storms and predaceous enemies. They carry the young mealy-bugs to the most desirable feeding places on the plant and by collecting the "honey-dew" keep them clean and so prevent parasitic fungi from doing them serious harm. Under this protective regime, the mealy-bugs have multiplied and extended their ravages on the cane crops. To prevent further extension of this damage, the state and federal government are now undertaking a poison campaign to exterminate the Argentine ants which are running the honey-dew dairy farms.

ACTIVITY of bandits in China has delayed an American scientific expedition, it was learned here to-day. Danger of losing equipment and valuable zoological specimens collected for the U. S. National Museum to marauding bands in a disorganized country has led A. de C. Sowerby, animal explorer for Robert S. Clark of New York, to withdraw temporarily from his field work in the region south of the Yangtze.

GRASS grown continuously under apple trees causes a disappearance of the nitrates from the soil and injures the trees' growth, experts of the Cornell University Agricultural Experiment Station have discovered. It has been previously held that the trouble was the moisture under the sod was less than in cultivated soil at certain times of the year. The Cornell men have found that moisture cuts a small figure and that it is the lack of nitrates which has the greatest effect.

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ADMISSION

Candidates for admission must be graduates of approved colleges or scientific schools with at least two years' instruction, including laboratory work in chemistry, and one year each in physics and biology, together with evidence of a reading knowledge of French and German.

Each class is limited to 75 students, men and women being admitted on the same terms. **Except in unusual circumstances, applications for admission will not be considered after July 1st.**

If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

INSTRUCTION

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

SUN FARTHEST NORTH—SUMMER BEGINS

By Isabel M. Lewis, U. S. Naval Observatory

Science Service

When, on Thursday, June 22 at 6:03 a.m. Eastern Standard Time, 5:03 a.m. Central Standard Time, 4:03 a.m. Mountain Standard Time, 3:03 a.m. Pacific Standard Time, the sun reaches its greatest distance north of the equator, or, as the astronomer would say, its highest northern declination, summer will begin in northern latitudes and winter in southern latitudes. At this time the sun is in the constellation of Gemini or the Twins which, we may recall, was visible in the western sky in the early evening in April and May. In a few weeks more, when the sun passes on in its apparent eastern circuit of the heavens into the constellation of Cancer, the Crab, the early riser may see this constellation of the Twins in the eastern sky before sunrise.

Some twenty centuries ago the sun was in the constellation of Cancer at the beginning of summer. Now the gradual westward shifting of the equinoxes, or points of intersection of the plane of the earth's equator with the plane of its orbit, which is called the precession of the equinoxes, has brought the sun into the constellation of Gemini at this time. For the same reason future generations of men, some twenty centuries from now, will find the sun in the constellation of Aries at the beginning of summer. In the time of Hipparchus the sun was in Aries at the beginning of spring.

At the beginning of summer in the northern hemisphere the sun passes directly overhead at noon in latitude 23 degrees, 27 minutes, North, which we recognize as the position of the Tropic of Cancer, also as the obliquity of the ecliptic or the angle that the earth's equator makes with the plane of its orbit. As the sun is now farthest north, June 22 is for us the longest day of the year, but for the inhabitants of the southern hemisphere it is the shortest day of the year.

Strange as it may seem, the earth is now in that part of its orbit farthest from the sun. Its aphelion, or the point in its orbit that is most distant from the sun, will be reached on July 5. The perihelion, or point nearest to the sun, is reached each year about January 2, or shortly after our winter begins. When in perihelion the earth's distance from the sun is about 91,400,000 miles and when in aphelion 94,400,000 miles, so that we are about 3,000,000 miles farther from the sun now at the beginning of summer than we were last December at the beginning of winter. If we lived in the southern hemisphere, however, we should find that we were three million miles farther from the sun at the beginning of winter than at the beginning of summer.

One might naturally expect, as a result, to find the winters much colder and the summers much warmer in the southern hemisphere than they are in the northern hemisphere. As a matter of fact, the seasonal changes appear, if anything, to be less extreme in the southern hemisphere than in our own latitudes. This is attributed to the fact that there is far more water surface in the southern hemisphere than there is in the northern hemisphere and it is well-known that temperature changes are less extreme over water than they are over land. There is no doubt, however, that if this factor were eliminated, the seasonal changes would be more extreme in the southern hemisphere than they are in our own latitudes.

THE SIZE OF METEORS

Science Service

That meteors as bright as the brightest star are no bigger than small bird-shot is a conclusion drawn by Professor F. M. Lindeman and Mr. C. M. Dobson, authors of a recent article in the "Proceedings" of the Royal Society. A meteor as bright as the moon would, they find, be only an inch in diameter and would weigh about two ounces.

As a result of their study, the authors conclude that the temperature of the upper atmosphere is much higher than was formerly supposed. It has long been known that the fall of temperature with altitude continues only to a height of about seven miles where the temperature is as low as from 60 to 70 degrees below zero Fahrenheit. But from this altitude as high as "sounding balloons" have gone, which is about 15 miles, the temperature has remained about the same. This is what is known as the stratosphere or isothermal layer.

The recent investigators of meteors now conclude that this layer of fairly constant temperature extends up to a height of 30 miles, above which the temperature again rises, so that at altitudes of from 30 to 50 miles it reaches considerably above the freezing point, or about the average temperature at the earth's surface.

The density of the air at a height of 60 miles is calculated to be one millionth of that at the

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surface. It is thought to be composed largely of ozone and its high temperature is thought to be due to heating by the long wave length heat waves from the surface of the earth.

DECREASE OF MALARIA

Science Service

MALARIA is generally decreasing throughout the United States, according to United States Public Health Service information, but in a few states a recent increase has been noted. Although the disease is now seldom found outside the southern states, it would be a mistake to assume that it is generally prevalent there. There are large areas of the south which are free of the disease or so nearly so that it does not assume the proportions of a public health problem.

Malaria is now prevalent only in certain regions of the Atlantic and Gulf coastal plain and along the lower Mississippi valley. It is there that it still constitutes a big problem, principally in the rural districts. The states of Mississippi and Arkansas show considerable increases in the number of deaths from the disease in the past year and although Missouri and Kentucky have shown a decrease over a period of years the results for last year show an increase. In the Carolinas, malaria is practically stationary after a marked decline some years ago. The upland and mountain regions of the south are practically free of the disease.

Testimony is general throughout the south that the disease has greatly declined there in the past twenty years. The "oldest inhabitant" of nearly every village can tell of how when he was a boy nearly everybody used to have their regular chills, while now the vendor of quack malarial cures finds little custom. The character of the disease has become more mild with the lessening prevalence and severe cases are increasingly rare.

PREHISTORIC GAMBLING GAME

Science Service

How a vanished race, which once lived in the isolated Rio Mimbres valley of southern New Mexico, shot craps has been revealed by prehistoric pottery dug up near Deming, New Mexico, by H. D. Osborn, of that place. In a scientific report just issued by the Smithsonian Institution, Dr. J. Walter Fewkes, of the Bureau of American Ethnology, who recently left Washington to make further explorations at the site of these discoveries, describes crockery showing scenes and figures from the daily life of a people whose very existence was doubted until a few years ago.

On the bottom of a broken jar there is a gambling scene representing three men playing a game with dice, the spots on which can be plainly seen. Just which one is winning it is impossible to say, as almost half of the picture is no longer visible. Arrows were apparently being used for stakes. One man seems to be down to his last arrow.

Another piece of pottery shows how these ancient Mimbres snared birds, while still another represents two men dragging a dangerous captured animal in such a way as to prevent his attacking either one of them.

Food animals, however, predominate in the pottery pictures, and from this evidence Dr. Fewkes concludes that animal food formed a considerable part of the dietary of these ancient people. Deer, antelope, rabbits, turkeys, parrots, fishes of many sorts, turtles, frogs and insects indicate that these early Indians were good observers, clever artists and possibly drew their pictures from nature.

Their artistic work was accomplished in an isolated valley whose rivers have no outlet to the sea, and Dr. Fewkes urges additional investigations in this valley which lies midway between the Pueblo and Mexican region and shows affinities with the culture of both.

ITEMS

HOUSING shortage among prehistoric cliffdwellers may have caused America's first "back-to-the-farm" movement. A report of explorations shortly to be published by the Smithsonian Institution declares that a study of pottery from ancient apartment houses built in the cliffs of Mesa Verde National Park, Colorado, compared with that from similar dwellings in the open country lends support to this theory. The character of the pottery renders "it easy to accept the theory that the Mesa Verde caves became so crowded with buildings that their inhabitants were compelled to move out and, having constructed pueblos, to settle on the mesa tops near their farms." The pueblo ceramics show evidence of changes in style, it is pointed out, and some of the pottery from the ruins recently excavated on the mesa is almost identical with that of the cliff houses. Other pieces are of a different type indicating that these open country villages were inhabited later than the houses built in the shelter of the hills.

AN artificial body of water which will produce 50,000,000 kilowatt hours of electrical energy for industries and will irrigate over 74,000 acres of land has been created on the Tirso River in Sardinia.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

THE ERUPTION OF MT. ETNA

Science Service

THE present eruption of Mt. Etna is a purely individual exhibition and not connected with the activities of any other volcano, not even with the eruptions of the near-by Vesuvius and Stromboli. Such is the opinion of Dr. Henry S. Washington, volcanologist at the Geophysical Laboratory of the Carnegie Institution.

Etna erupts with a sort of irregular regularity and it sometimes happens that these eruptions correspond with those of Vesuvius. But Etna is isolated while Vesuvius belongs to a whole group of volcanoes extending along the Alban Hills. The other members of this family are now dead, Vesuvius being the only survivor. The difference in the family relationship of Etna and Vesuvius is shown in the different chemical composition of the lava and gases emitted. Stromboli is another isolated individual, and being in moderate eruption at all times naturally does so simultaneously with Vesuvius and Etna.

Etna is older than the glacial period and has been periodically erupting since that time. A wide, deep valley down the southeastern slopes was formed by some tremendous eruption in prehistoric times. The first prehistoric eruption occurred in 693 B. C., and was referred to by Aristotle and early Greek and Roman historians. Since then eruptions have been known to occur at fairly frequent intervals, although during the Middle Ages few records were kept.

Since the eruption of 1669, which was one of the greatest of record, it is estimated that the volcano has poured out a cubic mile of lava. Some eruptions, notably those of 1169, 1669 and 1693, have caused great loss of life as owing to the great fertility of the disintegrated lava the lower slopes of the volcano are among the most densely populated regions of the earth. Dr. Washington said there was no danger that the lava would reach Taormina, one of the beauty spots of the world, and reported in some dispatches to be threatened. The configuration of the land would save it.

Volcanic activity in the Mediterranean has no relation with present eruptions of Pacific volcanoes or with earthquakes in Persia and other parts of the world. While not much is known about volcanoes it is certain that each draws its stores of lava from near-by, probably not more than ten miles beneath the earth's surface; while earthquakes, although frequently accompanying volcanic eruptions, occur usually from causes entirely different from those to which eruptions are due.

THE MEETING OF THE AMERICAN MEDICAL ASSOCIATION AT SAN FRANCISCO

Science Service

THAT eighty to ninety per cent. of all cases of illness can be treated successfully by general practitioners, and that ninety per cent. of all patients can be cared for efficiently in their own homes or in physicians' offices without the need of a hospital was the opinion expressed by the council on medical education and hospitals of the American Medical Association in a report to the House of Delegates on June 25. The meeting was the first of the annual convention of the association.

The council further suggested that modern medical knowledge and practice can be furnished to even rural communities if the citizens of such communities will guarantee the physician an income of $2,500 or more each year for a term of five years. It was stated that the number of hospital beds in the country has greatly increased in recent years, so that there are now about 6,570 hospitals, sanitoriums and homes in the United States. There are also listed 3,294 dispensaries and clinics which care for approximately eight million patients a year.

The average age of medical school graduates is now 26.8 years, owing to the lengthening of the courses of study in most colleges and schools, the council reported. Indications are that the number of medical graduates will be increased during the next five years by about 900 a year, reaching 4,500 in 1925.

A ruling of the federal prohibition authorities preventing a firm of pharmaceutical chemists from securing large quantities of alcohol on the grounds that it did not sell patent or proprietary medicines was called to the attention of the delegates by the bureau of legal medicine and legislation. An effort is being made to find the basis for the action by the prohibition commissioner. Efforts have been made to reduce the tax on physicians under the Harrison anti-narcotic act, and to secure advance notice of narcotic regulations so that they may be discussed before being made effective.

Dr. Olin West, secretary of the association, reported a present membership of 88,519 physicians

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PREVENTIVE MEDICINE

Science Service

PREVENTIVE medicine was the main topic of discussion at the session of the American Medical Association on June 27.

"Health," said Dr. Oscar Dowling, state health officer of Louisiana, "implies right conditions for the growth and development of the child, proper heredity, prenatal care of the mother, recreational direction and ideal environment. In securing these results every part of the body politic bears reciprocal responsibility."

A plea for more efficiency and less spectacular advertising in public health work on the part of volunteer organizations was made by Dr. Frederick D. Stricker, of Portland, Oregon. "There is need for some sort of regulation to prevent 'blue sky' health propaganda," he said in demanding that the public be informed just how the money contributed for public health is expended by volunteer agencies.

Constructive health activities were urged in the public schools by Dr. John Sundwall, of the University of Michigan. "School children should be taught ineradicable health habits," he said, "and should be instilled with a keen appreciation of the fact that maintenance of healthy bodies and their proper development are moral obligations they owe to society and to their country."

Babies catch cold because their parents and friends have colds for them to catch, Dr. W. T. Winholt and Professor E. O. Jordan, of the University of Chicago, told the delegates. They had made a study of babies with and without colds which showed such to be the case. Colds were more dangerous to babies than to grown-ups, as they tended to derange the digestion and other bodily functions.

An appeal to mothers to nurse their babies was made by Dr. M. L. Turner, of Des Moines, Iowa. "Animals nurse their young as they have done for centuries," he declared, "only the genus Homo has gone astray." Dr. Turner urged physicians to tell mothers that the good of their babies and the good of the race demanded that they give their infants their natural food which no artificial product could equal.

The case of a 19-year old girl who reverted for one month to a period in her life corresponding to the age of four years was described. She showed for this time nothing but childish traits and lost all memory of recent happenings. Later she recovered and remained normal for five years. A severe recurrence ending in death followed. An autopsy showed no apparent abnormal condition other than a general inflammation of the membrane covering the brain.

An infection of the human eye by the eggs of the sheep-bot, a common sheep parasite of the southwest, was described by Dr. H. H. Stark, of El Paso, Texas. This is the first case of its kind recorded in the United States. The patient was a 16-year old girl who suffered from inflammation of the eyeball until the offending organisms were removed. An eye infection by the organism known as filaria, common in the tropics, was reported by Dr. J. W. Kimber, of Kansas City, Missouri. This is also very rare in this country, cases occurring commonly only in returned missionaries or others who have lived long in tropical countries.

ITEMS

FOR the first time an accurate map of the ancient Maya empire that flourished in Central America before the time of Christ has been made by the Carnegie Institution of Washington. A surveying party consisting of Oliver Ricketson, Jr., and W. A. Love, of the Institution's scientific staff, and Jerome O. Kilmartin, of the United States Geological Survey, has just completed three months of exploration in the bush of Guatemala. Equipped with a standard United States Navy wireless receiving set, accurate chronometers, magnetic and other scientific instruments, these scientists accurately located ruins of ancient Maya cities in the department of Petan in that country. Latitude, longitude and altitude were determined and at many places observations were also made to determine the dip and variation of the compass. Itsimte, Tayasal, Ixlu, Tikal, Uolantun, Uaxactun, Nakum, Naranjo, Ucanal, Xmakabaktun and Xultun are the names of some of the cities that were geographically located after having been deserted for centuries and long over-grown by tropical forests. Lack of water hampered the explorations at times, the scientists reported. Archeological research into the past of the great Maya empire will be greatly aided by the topographical work that has just been accomplished, officials of the institution believe, and the observations obtained will reveal new facts about this ancient American civilization.

AS a result of the recent rubber depression in the Federated Malay States, extensive experiments are being made in the cultivation of various crops suitable to the development of more diversified farming.

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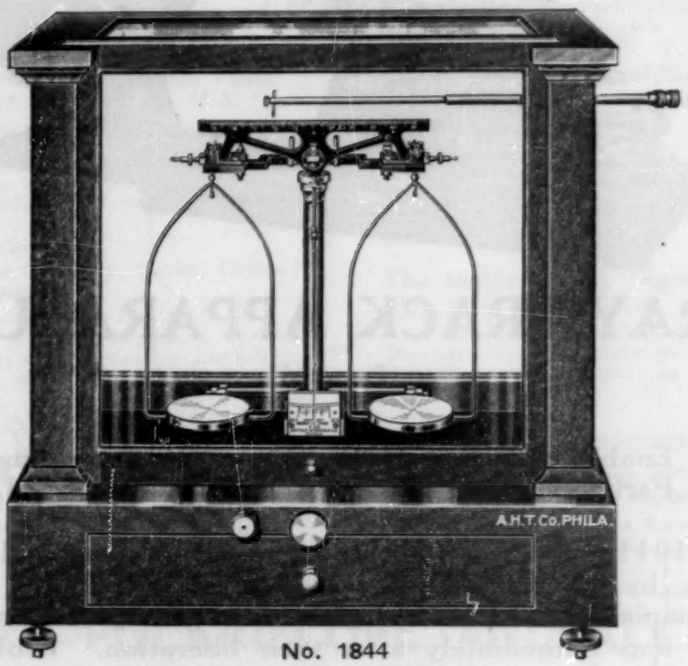

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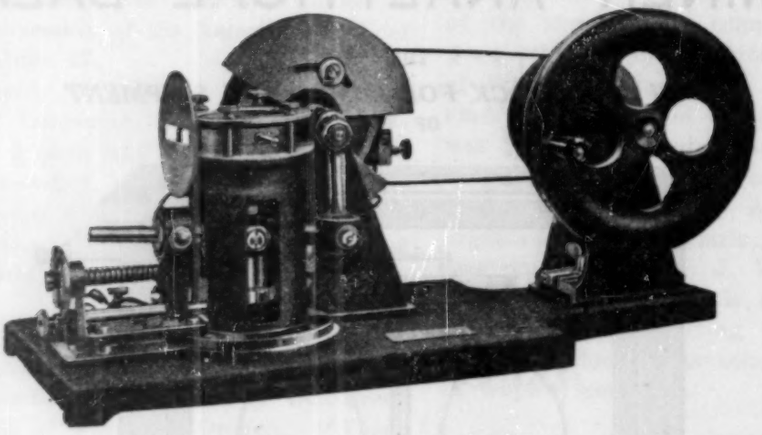

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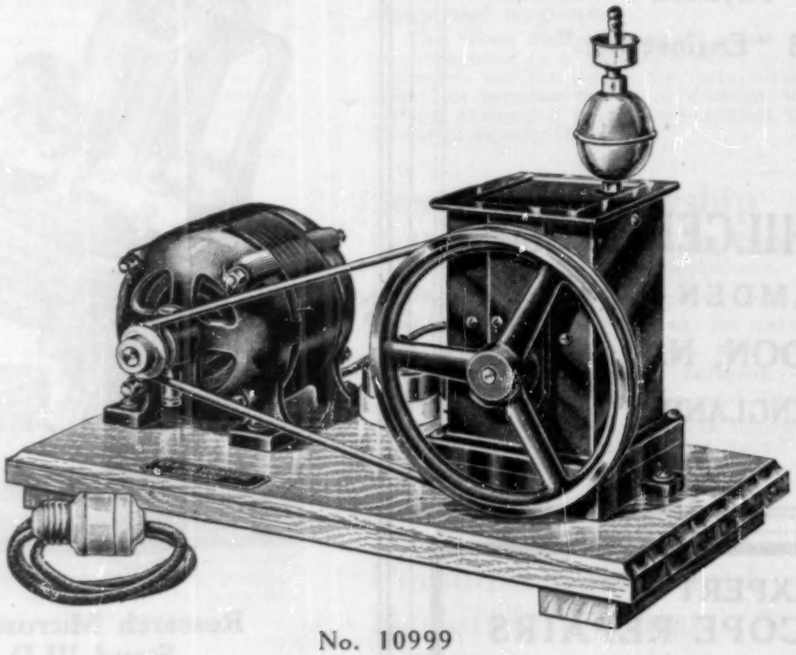

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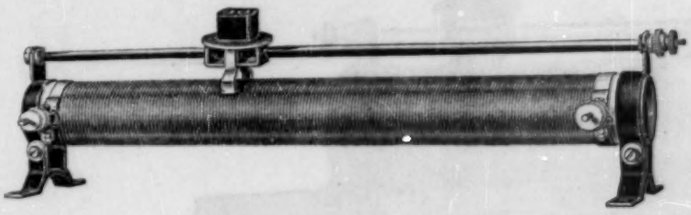

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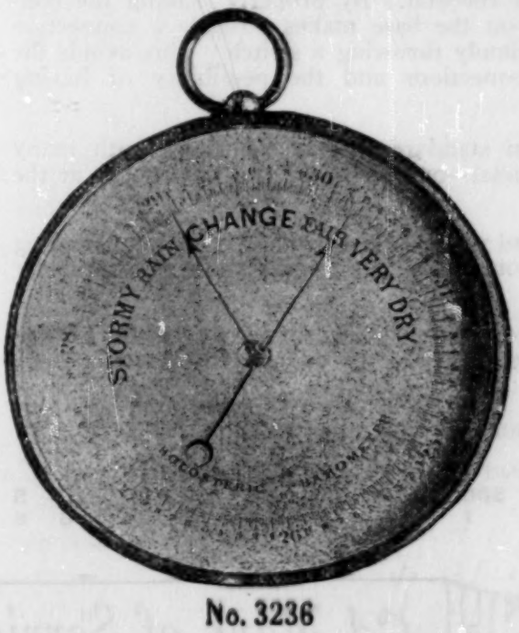

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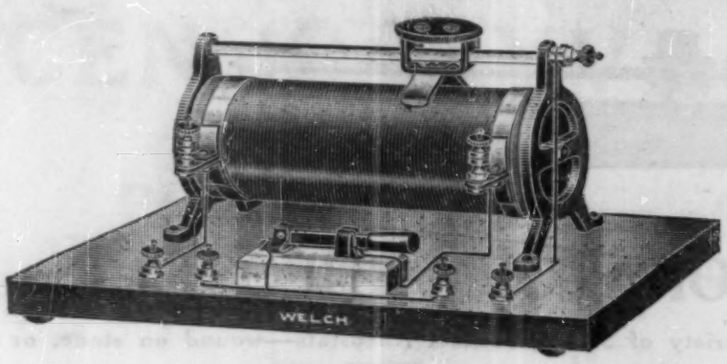

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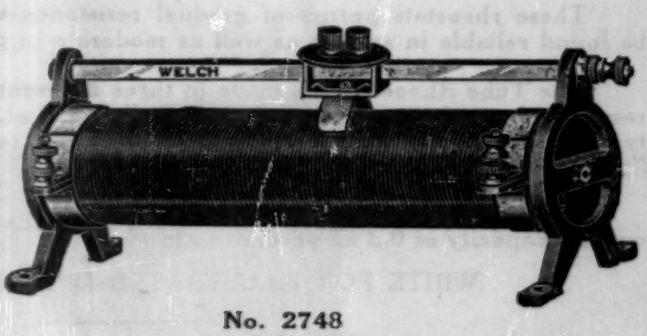

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